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Journal of Electricity

Devoted to the Economic Production and Commercial Application of Electricity
IN THE ELEVEN WESTERN STATES

PERIODICAL DIVISION MAR 26

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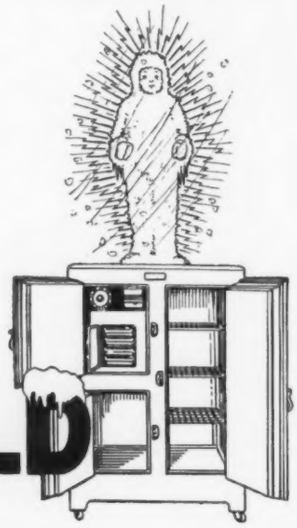

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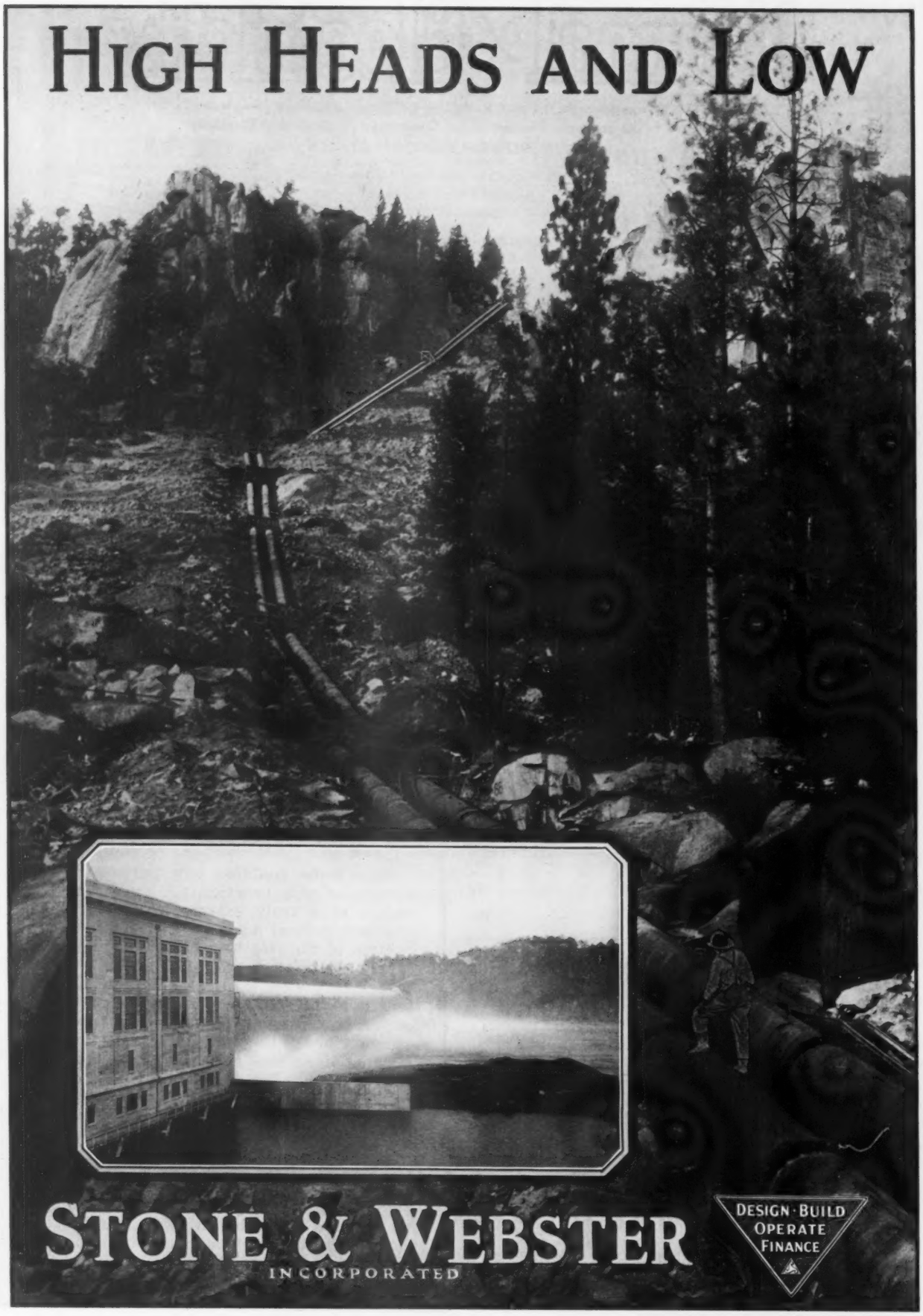
Significant Gatherings

PRACTICALLY all well planned and arranged gatherings for the discussion of questions of importance to a particular group bring forth in concentrated form the wisdom of the best minds engaged in a study of those problems. It becomes the province of a sincere technical journal to interpret and summarize the thought of such gatherings that the many who are unable to attend in person may find the magazine their true representative.

Aside from reporting the significant activities in the field covered by it, of which the report on the progress of the experimental arch dam, published in this issue, is a typical and valuable example, the Journal of Electricity endeavors to have its trained representatives bring to its columns the best thought expressed in significant public gatherings in which subjects of import to the electrical West are discussed.

This issue contains two noteworthy examples of this practice. A most complete report of a truly extraordinary gathering, the first general meeting of the Commercial Section of the Northwest Electric Light and Power Association in Spokane, Feb. 18-19, brings to the industry the attitude and research of the Northwest upon sales efforts in electric ranges, domestic refrigeration, commercial lighting, rural electrification and residential rates. Each of these topics is one in which the industry as a whole is deeply concerned.

Of more general interest than any other single phase of development in the entire West today is the Colorado River problem. At the Commonwealth Club of California, Feb. 18, leaders of the respective contesting factions gave their views. A digest of those variant aspects of the situation may be found in these pages, also.


HIGH HEADS AND LOW
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EDITORIAL

What Place the Electrical Engineer?

IN this day of short cuts to everything there is a tendency to shunt past the electrical engineer in the design of large buildings, a tendency which should be regarded with real concern. In the passing by of this important member of the electrical fraternity there can result only a condition of more or less slipshod work for which somebody is going to have to pay in the long run.

It is quite possible that the electrical engineer may be considered only an added burden to a construction project. Many unthinking contractors and architects have been known to hold this attitude. With the dissemination of a smattering of electrical engineering practice in the training of salesmen, this negligence to call upon the trained expert conceivably may grow more common.

Will it not be well to consider for a moment, therefore, just how important the electrical engineer is to a job?

To begin at a vital point, it is more than likely that the electrical engineer will put enough copper into the job to carry the load demanded of it. Moreover, it is likely, too, that he will put in enough copper to carry sufficient overload so that the demands of natural progress will find capacity to meet at least a large percentage of those demands. This is all in the eventual interest of the client, whether he has sense enough at first to see it or not.

The electrical engineer will save the electrical contractor money because of the definiteness of his specifications and the ease with which the contractor's men can put in the job afterward from well drawn plans.

The central station benefits from the fact that the job can carry an overload if it can sell the tenant the apparatus with which to use electricity. It also benefits from the fact that the customer is better satisfied with his installation and gives the central station the credit for it.

The owner of the property is the one who benefits more permanently. If the architect, wishing to save on his expenses so that he may make his fee larger, neglects to call upon an electrical engineer for the electrical layout of a large job, he sometimes finds later that he must put on such an engineer to inspect the job while it is being done, to guarantee to him and his client that the electrical contractor does all that is expected of him. Such a service nearly always costs that architect more than if he had called in the engineer in the first place. The electrical contractor is often forced to lose money on closely figured estimates from indefinite specifications, and worst of all, the owner of the building gets a job which hurts it from an investment standpoint.

It is reported on good authority that certain buildings built under such a plan are the most expensive buildings in a certain large city to maintain and to keep rented. Because the electrical equipment in them is inadequate, tenants are harder to find and rents are consequently lower. On the other hand, buildings on adjacent lots, because of completeness of electrical installation and capacity, are in demand for office quarters at all times.

Certainly the electrical engineer should be eliminated no more than the architect himself, than the contractor, the individual workers necessary to construct a building. And certainly every branch of the industry suffers when he is eliminated. His presence is paid for in some way whether he is employed or not. In most instances it is far better that he should receive his pittance for doing a good job than that he should be paid for in regrets.

Electricity in Merrie England

ENGINEERS returning from voyages abroad are generally unanimous in their estimates of the situation as regards electric supply in Great Britain, placing it variously as being from ten to twenty years behind the development in this country in many respects. These are not merely self-satisfied and superior personal opinions of the situation, such as this younger country is often accused of holding up the "old country" in a spirit of ridicule. Goodness knows America is held in semi-contempt with respect to its cultural requisites by Europeans, if one is to take the prevailing lecturing European gentleman seriously. This estimate of the electric situation is no mere matter of opinion or viewpoint. It is a cold-blooded engineering estimate of a very obviously contrasting situation.

England's electricity supply, as it is termed there, is dependent upon a great multitude of small isolated plants, operating at varying frequencies, voltages and efficiencies. This is a condition which found its counterpart in America from ten to twenty years ago. Each community, whether it be a community within the boundaries of a large city, or itself a town, if it has electricity, has its own little plant, distribution system, and individual frequency and voltage. Very few systems are linked together to provide what we now consider an ob-

vious necessity, continuity of service in case of breakdown of one of the small plants.

But there is a government movement under way in England to centralize generating plants to a few large efficient plants, interconnecting these plants by means of a network of transmission lines similar to those found economical and successful in the United States. The scheme naturally implies a standardization of voltages and frequencies and other operating requirements. The plan thus far proposed calls for an "Electricity Board," which shall buy wholesale the product of the large individual plants and operate a common bus-bar transmission system from which the individual communities may buy power.

Whether the proposed plan in respect to the government "Electricity Board" is workable and desirable is not for an outsider to say. We in this country do not know political conditions in England well enough to comment intelligently upon the subject.

What is interesting in the light of this scheme is that interconnection, centralization of generating plants, and standardization of operation are held in question in favor of still further extension of the isolated-plant idea. That question, in the light of experience in similar physical environments in the United States, is no longer a question. It is relegated to the past together with the three-toed horse.

A correspondent of the "Electrical Review," foremost of English trade publications dealing with electrical subjects, raises that question, nevertheless. And he strives to prove his point by showing that in a particular case a certain town found that it would be cheaper to install its own internal-combustion-engine plant than to buy electricity from a neighboring town from which a transmission line of 18 miles would be required.

The facts as presented are no doubt unimpeachable, but the point of the matter is that the correspondent takes a characteristically short-sighted view of the problem. He has not realized the economies available in a possible commercial expansion resulting from the existence of these power-transmission lines. True enough, one little town buying power at a distance of 18 miles from a station would offer little in the way of advantage, but considering that there are five or six more towns in the same 18-mile radius and many times that number in a 40 or 50-mile radius in which two or three large plants might serve a loop system of transmission lines economies appear to be possible.

Besides, with small plants operating at varying frequencies, there is no encouragement to uses of energy for other than lighting load, whereas with standardized frequencies, manufacturers might well dispose of many times as many current-consuming devices which would build up the central-station load to reduce operating cost still further. It is being done every day in America, and is not even open to question here.

Far be it from the American cousin to give his British relative advice. Yet it would seem foolish of a nation noted for its men of intellect and culture to hold itself in check for many years for want of vision and ordinary appreciation of some of the engineering facts which have been tested and proved in this crucible of enterprise, America.

Construction Starts on Experimental Arch Dam

ANNOUNCEMENT that actual construction has commenced on the experimental arch dam on Stevenson Creek, California, is of more than passing interest to engineers. As has been previously stated in these columns, the proposed studies by Engineering Foundation's committee on arch-dam investigation are expected to reveal much information which will be of value and interest to hydraulic engineers. Engineers expect that data will be developed which will have a direct bearing upon future dams of this character and will be reflected in much lower costs.

Heretofore there have been little or no design data for such structures. Because of this lack of information there has been a tendency to use more materials and to make dams more massive to insure a proper factor of safety. For this reason costs have been greatly increased. Arch dams have been used for centuries, and, although there has not been a single recorded failure of a concrete or masonry arch dam, their design is a matter of conjecture. The investigation will change this.

Aside from its bearing on future hydroelectric developments, the investigation will be of interest to the electrical industry because measurements of deformation, deflection and temperature are to be made by electrical methods. Special apparatus has been developed for this purpose. Descriptions of some of this equipment will be found on another page of this issue.

The entire project is being financed by contributions from manufacturers, power companies and others interested in the investigation. While the support it has received has been generous there are those who have not contributed who might well do so. At any rate when the studies have been completed a new contribution will have been made to engineering.

Function of the Club Publication

THE R.P.M., published organ of the Seattle Electric Club, celebrating its third anniversary, describes its function in its February number in part as follows: "This publication has tried to chronicle these events, telling them in lighter vein, lest their importance be exaggerated. The real motive of the R.P.M., as its editors see it, is to spread good cheer, disseminate gossip in the friendliest spirit, make fun and by these ties draw the membership of the club into closer fellowship." It then continues further to elucidate its policy, answering possible criticism, and commending its readers to the trade journals for the more substantial and meaty material concerning the industry.

Truly the stated purpose of the R.P.M. is laud-

able. "Lest their importance be exaggerated"! How important it is that the importance of events be not exaggerated! Humor, delicate satire, harmless sarcasm, good-natured banter—potent stabilizing influences are these. Let there continue to be media through which they may operate to prevent all of us from an occasional tendency to "mountainize" molehills and to see great engulfing waves instead of ripples on the surface.

We have found the R.P.M to be, as it describes itself, "a carefree wight." The lighter vein does indeed color the sprightful recital of news in its columns to the extent that we imagine it fulfills its stated purpose. Congratulations to you, R.P.M., on your birthday, and more revolutions to you, that you may carry on in the cause of fun and fellowship.

Are Men Better Demonstrators Than Women?

THOSE who champion the "rights of women," the nineteenth amendment and all that sort of thing, would have been pained perhaps, if not aroused to caustic comment, to hear a speaker in a recent committee meeting claim that as demonstrators of electric appliances women were not to be classed with men. Naturally enough the contention brought forth opposing views, for the subject of woman's fitness for business careers always will bring forth warm controversy.

The basis upon which one speaker made his assertion was this: "A woman demonstrator, by showing that she knows more about an appliance than her prospect, antagonizes the prospect and does more harm than good. Women do not like to be shown that they do not know as much as another woman, and the demonstrator who is a master of electric cooking, for instance, makes the prospect feel jealous and really hurts the sale. On the other hand, a man, not pretending to know all about cooking, can demonstrate the appliance more from a selling angle."

Those who differed with him said: "Of course there are women demonstrators, and women demonstrators. And the right kind of woman demonstrator is tactful and doesn't try to impress her prospect with how good a cook she is, but how easy it is for an average woman like herself to master this electric servant. And women will get entré into a home where and in a way that no man can. A good woman-demonstrator goes into a woman's home, and while she is taking off her hat and coat comments on her hostess' tasteful draperies or furnishings, talks about things of the home as only a woman can talk of them to another woman, and establishes confidence for herself and the company she represents that no male salesman can quite attain. And the sale of the appliance is made more naturally and easily as a consequence."

And, ladies and gentlemen, there it stands. It is as much settled now as it ever will be. But the fact remains that many wise merchandisers will select men and many will select women, and that both probably will bring in increased business, according to the merits of the individual cases. It resolves itself simply into a case of salesmanship, and after all, the sex of the salesperson has very little to do with it.

He Who Gets Whacked

THE "Trolley Philosopher," as he terms himself, of Los Angeles Railway, sifts much wisdom in with his humor in that genial task of acquainting the riding public with the facts about transportation. In a recent issue of the little leaflet, Azuride, he speaks of the old political cry, "Whack the corporations," and points out in breezy words that such a cry is in reality one to "whack the voters."

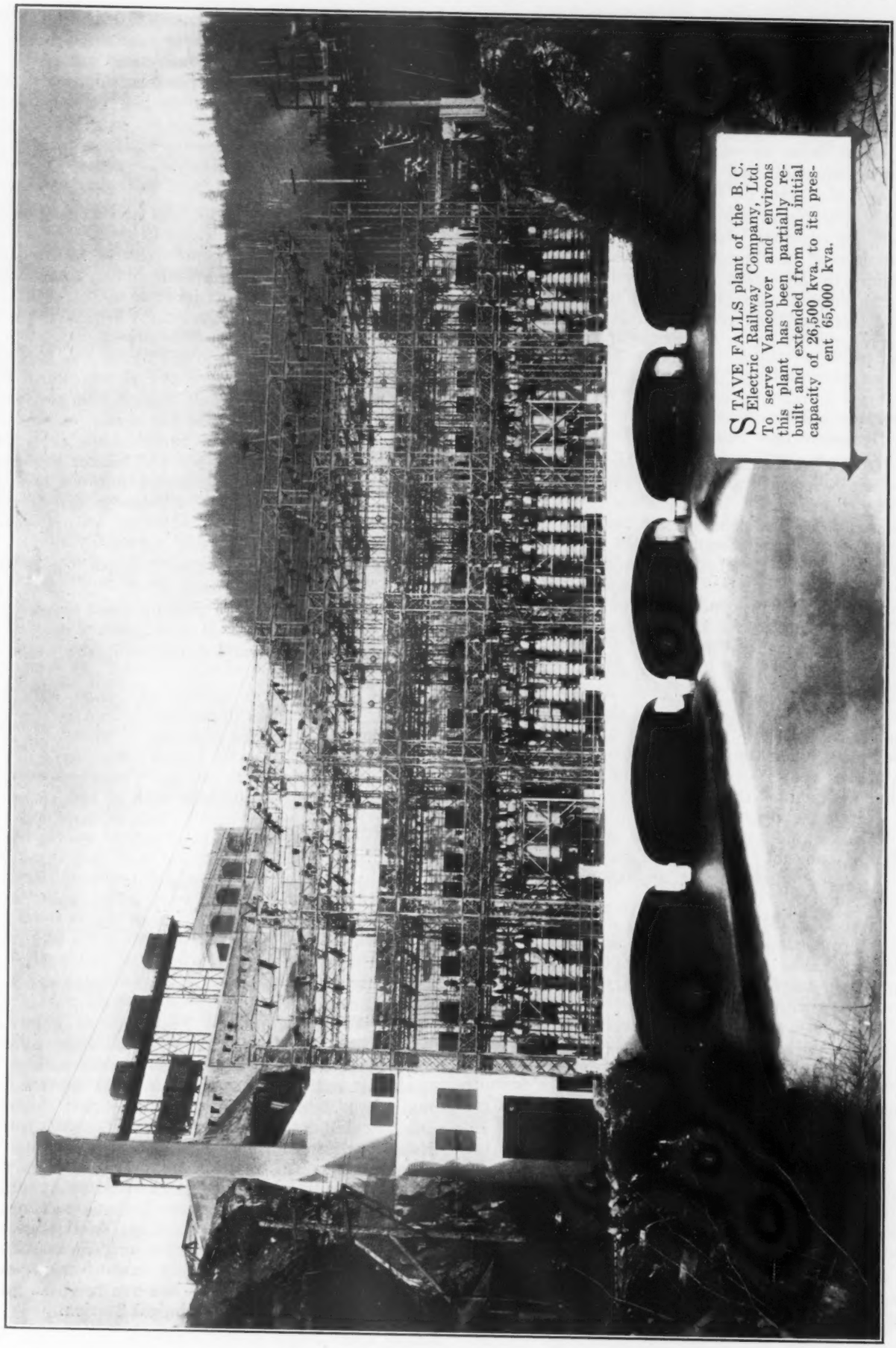
"In years gone by," says the philosopher, "the professional politician would mount the platform, swallow a tablet to disguise his breath as the lily of the valley instead of the barrel of the alley, and claim that he was just 66 per cent nearer to purity than Ivory soap. Next he would promise that, if elected, the farmers would receive plenty of rain for their crops and the First M. E. church piano would keep in tune.

"The politician's code called for the 'whack the corporations' keynote at that point. Railroads and gas companies, etc., were promptly laid low with a blast of fiery oratory. It was great vote-getting thunder, but as the earthquake said, 'The world do move.'"

Continuing more seriously, he points out that utilities are the most important factors in city development and that for a people to whack the corporations is in effect to whack themselves. The creation of obstacles to hamper public-service corporations in giving service is nothing but an interference with the necessary conveniences of the public, a fact of which the public is becoming aware. "The old tactics have lost their spell because the public utilities are builders of cities."

Business First, the Right Policy

IT is gratifying to note the conservative and business-like air that pervades the conclaves of the Technical Section of the Pacific Coast Electrical Association. Full attendance at all sessions and an active participation in committee discussions by those attending show sincere interest in technical matters of importance to their respective companies. Social activities fade into the background. Even luncheon and dinner meetings are devoted to the discussion of matters of actual constructive value. Through these discussions and interchanges of information come economies in design and operation that result in good showings on the balance sheets of the utilities participating. The continued interest and support of utility executives are well earned, and congratulations are due to those guiding the activities of the Technical Section.



STAVE FALLS plant of the B. C. Electric Railway Company, Ltd. To serve Vancouver and environs this plant has been partially rebuilt and extended from an initial capacity of 26,500 kva. to its present 65,000 kva.

The Stave Falls Development

By E. E. Carpenter
Consulting Engineer, British Columbia Electric Railway Company, Ltd., Vancouver, B. C.

IMPROVEMENTS and additions at the Stave Falls hydro plant of the British Columbia Electric Railway Company, Ltd., make available to that company's system another 21,000-kva. block of power. The betterment of Stave Falls was and is a step in the further development of the hydraulic power possibilities contemplated in the Alouette-Stave-Ruskin project of that company.

RECORDS of power usage in and around Vancouver, B. C., covering a period of some fifteen years show a consistent increment of load increase of from 8 to 10 per cent. This means that the load is doubling every seven to nine years and that generating capacity must be increased accordingly. The generating capacity of the system of the British Columbia Electric Railway Company, Ltd. as of 1925, including those plants under construction, totaled 123,325 kva. To double this figure by 1934 means an average annual expenditure of about $3,000,000, The Stave Falls improvement described by Mr. Carpenter in the accompanying article is one of the steps of the 10-year program.

The work embraced by the last-mentioned project includes the development of storage and power at Alouette Lakes; the raising of existing dams and the erection of a new dam at Stave Falls; the rebuilding of the four original units at Stave Falls and the installation of a fifth unit, and the construction of the Ruskin dam and power house at a point about three and one-half miles down-stream from Stave Falls.

Of this work the Alouette dam and tunnel have been completed and the water thus impounded diverted through a tunnel into the upper end of Stave Lake. Initial construction work is under way on the Alouette power house, which will utilize the head between Stave and Alouette Lakes. All construction and rebuilding operations at Stave Falls are essentially complete. The Ruskin development is for the future.

General Features.

Initial development of the Stave Falls project was carried on by the Western Canada Power Company, which was acquired by the British Columbia Electric Railway Company in 1921. Original provisions were for a maximum water level of 318 ft., control equipment and penstocks for four 8,825-kva. generating units, three of which were installed in 1911. Improvements and additions undertaken in 1922 and now essentially completed include the installation of the fourth and fifth generating units, the raising of the intake dam, the building of the west wing dam and the Blind Slough dam, and the filling in and raising of the sluice dam. The new water level represents a net increase in operating head of 22 ft. over the original. A new penstock and additions to power house building, tail race and switching equipment of course also were necessary.

Stave Lake, as it stands today, is about 17 miles in length and 1½ miles in width. Its basin is clearly of glacial origin, the receding glacier of morainal dams, the remnants of which combined with occasional spurs of bedrock formed the barrier that held the original lake in place. The continuing erosive action of the river cut deeply into these natural gravel dams and even into the bedrock itself, leaving behind a series of terraced gravel banks along the valley. The lake terminated at a point about seven miles above the present site of the Stave Falls plant, but once again spread over its original bed when the water level was raised at the latter point.

Water Supply.

The watershed is unmapped, but is estimated to cover an area of about 450 sq. miles. This lies on the westerly slope of the Coast Range Mountains. In the main, this area is heavily wooded, but in the upper portions the elevations run above the timber line. The principal peak within the watershed is Mt. Baldy, which rises to an elevation of more than 6,000 ft.

Water supply records of the eighteen-year period from 1906 to 1923 show the mean annual run-off to be 3,880 sec. ft. Rain gauges at Stave Falls show the average annual precipitation at that point to be 78.3 in. This figure, however, compared with the run-off figures shows conclusively that the precipitation in the upper portion of the watershed must be much heavier than at Stave Falls. As a matter of interest and comparison the following table of monthly average rainfall is given:

January	10.4 in.
February	6.64 in.
March	7.66 in.
April	5.27 in.
May	4.21 in.
June	3.69 in.
July	1.82 in.
August	2.87 in.
September	5.24 in.
October	8.22 in.
November	11.39 in.
December	10.89 in.

Stave Lake is capable of impounding 471,000

acre-ft. of water. With this amount available for low-water periods the dependable continuous flow for power purposes may be taken as 3,500 sec.-ft. This is augmented by the continuous supply of 700 sec.-ft. from Alouette Lake, so that the total available at Stave Falls is 4,200 sec.-ft. at a maximum head of 130 ft., a minimum head of 96 ft. and an average head of 115 ft.

Intake Dam.

The intake dam closes the westerly channel of the river and lies about 200 ft. upstream from the power house. In it are set the intake gates, screens and other control structures for the proper feeding of the four original penstocks. The original dam, as constructed in 1911, was about 55 ft. in maximum height, 160 ft. long and designed to accommodate a high lake level of 318 ft. elevation with a freeboard of 7 ft. Provision was made for raising. Four radial Tainter gates, 19 ft. wide by 20 ft. high, controlled the flow to the penstocks. Timber stoplogs were set in bays upstream for emergency control.

About 8,800 cu. yd. of concrete were used in raising this dam to a crest elevation of 345 ft.; 5 ft. above the new lake level. The Tainter gates were removed and the large wells needed for their proper setting were filled with concrete to give the necessary weight to the new structure. They were replaced by four structural steel gates of the fixed-roller type, measuring 20 ft. wide by 21 ft. high, clear opening. The four hoisting winches for the gates are mounted upon a steel structure extending over the entire length of the four gate openings. These winches are operated through separate clutches by a cross-shaft driven by a 15-hp., 125-volt, d. c. motor set at about the mid-point of the shaft.

Fig. 1.—View at the head of Stave Lake; typical of Alouette-Stave higher watershed.

Steel stoplogs replace the old wood logs. They are constructed of two I-beams connected with

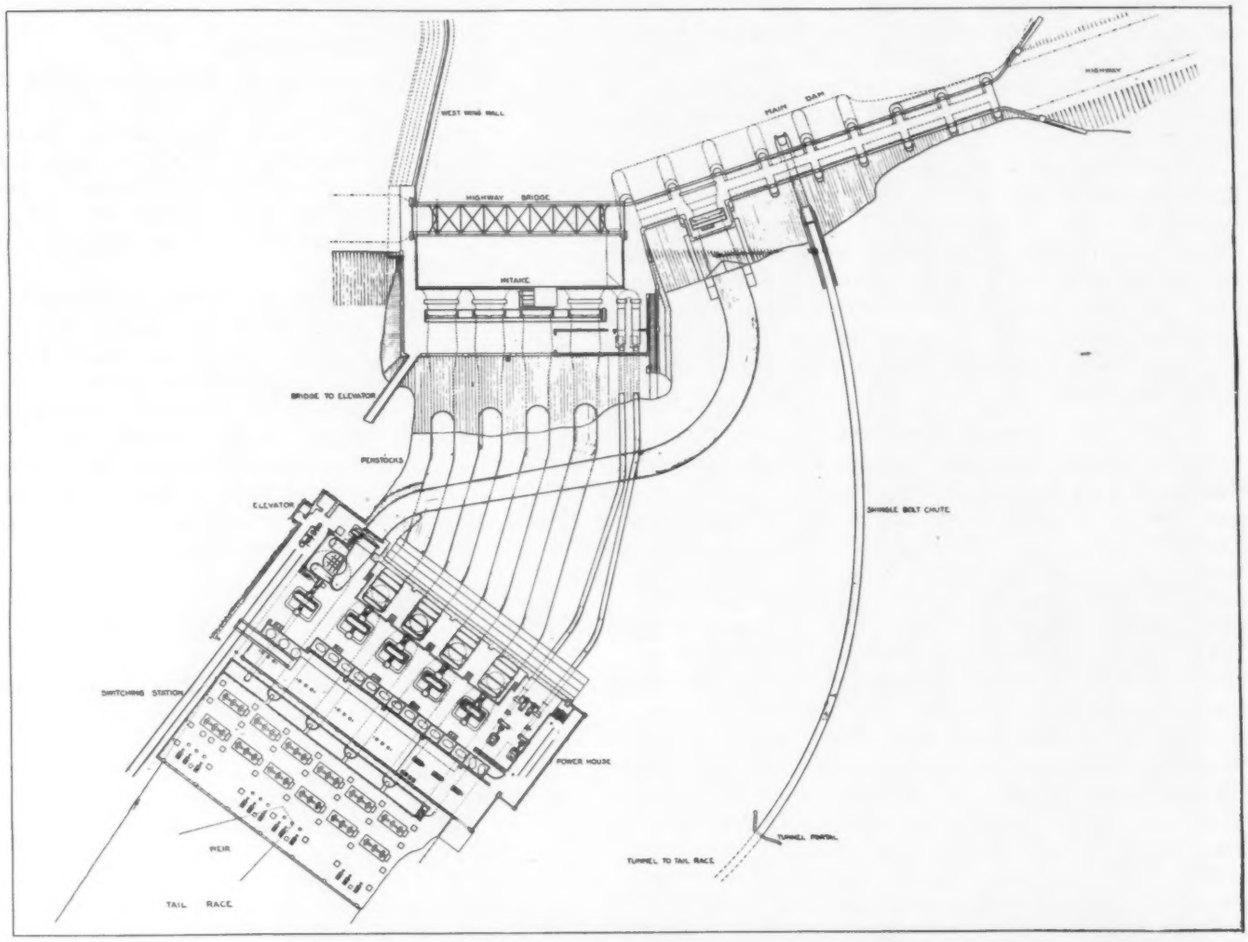


Fig. 2.—Plan view showing relative positions of penstocks, intake dam, main dam and power house.

riveted channels and plates and filled with concrete to give the necessary weight to permit placing. The stoplogs are handled and placed by a traveling hoist operating on a 9-ft. gage track extending the length of the gate openings. The arrangement permits the rapid and safe closure of any of the openings with the one set of stoplogs. The engaging and lifting of the logs is accomplished by means of a master log provided with catches at each end.

West Wing Dam.

At the west end of the intake dam the bedrock dips sharply westward and plunges beneath the overlying strata of glacial clays, gravels and boulders. Explorations indicated that foundations for cut-off walls on bedrock could not be reached. To remove the danger of seepage in this zone a heavy retaining wall was installed. This wall is about 280 ft. in length, connecting with the west end of the intake dam and extending upstream some 150 ft. where it curves inshore. The wall contains about 3,900 cu. yd. of concrete, is 50 ft. in maximum height, rests upon bedrock for a distance of about 160 ft. from the intake dam and upon clay and hardpan the rest of its length. About 20,000 cu. yd. of backfill were required for this wall. Part of this was sluiced in and part placed by dump cars. All was water-settled.

Main Dam.

The new main dam was the sluice dam of the original installation and as such was designed to discharge the entire flood of the river. The old dam was filled in and raised to the proportions of a solid gravity section concrete structure with crest elevation also at 345. Of the five original bays four were filled in solidly and the fifth used as the aperture for the penstock for the fifth unit. Approximately 9,500 cu. yd. of concrete were used in this dam.

The intake for the fifth unit is located in the second bay from the east abutment of the intake dam. A fixed-roller gate is provided with an operating mechanism similar to that used for the others. The old stoplog checks were utilized for the protecting screens.

One of the most ingenious features of this dam is the shingle-bolt chute. This chute provides for the uninterrupted passage of shingle bolts through the dam and into the tailrace below the power house at all stages of water level. The large quantities of bolts produced along the lake made this feature a necessity. Its operation has proved to be efficient. With a water supply of 25 sec.-ft. it is possible to effect a continuous run of 10,000 bolts through the chute, flume and tunnel into the tailrace in eight hours.

Blind Slough Dam.

Before the improvement this most easterly and well-elevated portion of the old river bed was closed by a small rock-filled timber crib structure with ten 6 by 14 ft. sluices which served as an auxiliary spillway. Raising of the water level caused the abandonment of this old dam and the construction of a concrete dam 640 feet long. This new dam consists of a series of heavy piers with 14 spillway bays between piers. It contains 20,000 cu. yd. of concrete. Ten of the 20 by 28-ft. bays are closed with stoplogs and the remaining four, on the west end, are closed with the Tainter gates removed from the intake dam. The openings which these gates control were reduced to 19 ft. 6 in. by 19 ft. ½ in. The sills of the ten bays are at El. 320 and those of the latter four bays at El. 294. The operating winches for the Tainter gates and a motor-generator set for supplying the local power are located in a gate house erected upon the deck of the dam. Each winch is operated by an 8-hp., 125-volt, d. c. motor.

With the water level at 340 the combined discharge capacity of these 14 spillway openings is 96,000 sec.-ft. The largest flood ever recorded for the river occurred in 1921, and mounted to about 60,000 sec.-ft.

Upstream from the face of the dam slots are provided to accommodate the traveling emergency gate. This emergency gate may be placed in any of the openings to relieve a gate for repair or adjustment. This gate is of the fixed-roller type, quite similar in design to the penstock intake gates previously described. When not in use the emergency gate is lifted clear of and stored at the end of the dam. The stoplogs are of timber, two pieces boited together with a steel stiffening plate between. The stoplog machine formerly used at the old sluice dam is used to handle these logs.

Extending across above the crest of all of the dams is a 16-ft. roadway to accommodate travel.

Initial arrangements provided for a maximum of

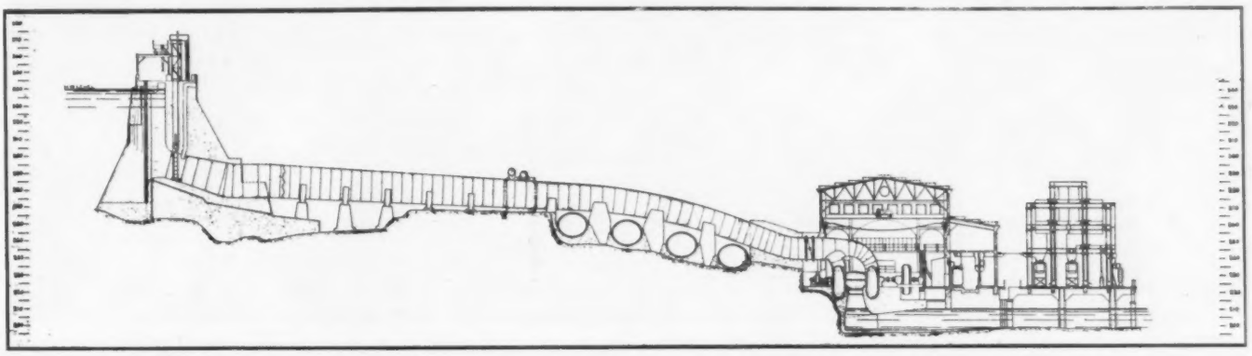


Fig. 3.—Cross-section through fifth unit and along the line of the penstock for that unit.

four 14-ft. 6-in. penstocks, the average length of which is 190 ft. This condition made necessary the selection of a new location for the installation of the fifth penstock. Several different plans were considered, among them being that of placing the fifth unit in a separate building immediately below the main dam. Control and other complications, however, caused the adoption of the plan to extend the power house westward into the solid rock and install the new unit at that end of the power house. This arrangement of units made necessary the crossing of the four original penstock lines by the fifth. Hence the new line emerges from the main dam as previously mentioned and is carried across the other four lines to the position of the fifth unit at the west end of the power house building. A double bend thus is necessitated, something of an S curve. Suitable piers are provided to carry the new line. The new line is 20 ft. in diameter at the intake end and tapers continuously through its 324-ft. length to a diameter of 13 ft. at the butterfly valve at the power house wall.

Machinery.

The four original turbines are of the double horizontal Francis type with central discharge. They operate at 225 r.p.m., and are enclosed in 18-ft. cylindrical casings, to which the penstocks are connected axially. These casings are of ¾-in. steel plate with heavy forged steel flanges and a cast steel end-plate designed to take the full hydraulic thrust. Runners are 63 in. in diameter, built of steel plates cast into a steel hub. Bearings are water-cooled. Draft tubes are moulded carefully in concrete and are expanded from an 8-ft. circle at the point of contact with the casing to a 9-ft. 5-in. by 21-ft. 9-in. rectangular opening at the discharge end. These turbines were supplied by the Escher Wyss Company of Switzerland.

Four high-pressure oil-operated governors of the same make are supplied with oil at 300-lb. pressure from a central pumping station. Two pressure oil pumps driven by impulse wheels supplied with water from the exciter penstocks handle the oil. Either is capable of supplying all four governors.

Two 250-kw. 125-volt exciters are driven by 500-hp., single-runner, Francis type turbines, each fed by a 46-in. penstock.

The four original generators were supplied by the Canadian General Electric Company. They are 3-phase, 60-cycle, 4.4-kv., 225 r.p.m. machines and were originally rated at 8,825 kva. Tests made on one of these machines showed that the turbines were capable of developing 10,800 kva. Accordingly the four original generators were rebuilt by the manufacturer to that capacity.

The fifth unit turbine and governor were supplied by the Canadian Allis-Chalmers Company. The turbine is of the double-runner, spiral-casing, single-discharge, horizontal type, operating at 225 r. p. m. Its normal rating is 15,000 hp. and its efficiency guaranteed at 80 per cent for full load and 87 per cent at 85 per cent load. Because of the fact that the penstock for this unit had to come in over the existing penstock lines and consequently at a greater elevation it was impossible to install a unit similar to the original four. The fifth unit penstock comes in above the unit and is split to serve the two wheels.

A normal rating of 13,125 kva. and a two-hour overload rating of 16,400 kva. is ascribed to the number five generator unit. This unit, together with its attendant transformer and switching equipment, was manufactured by the Canadian

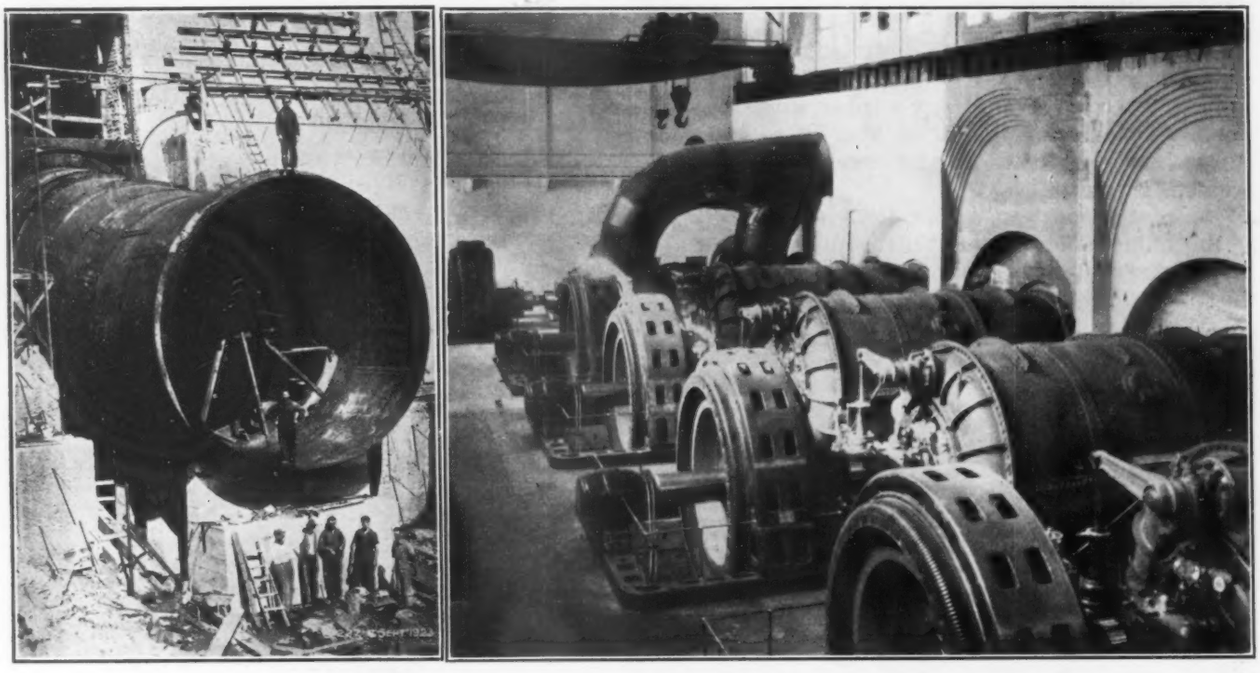


Fig. 4.—Left: Penstock for fifth unit showing size of pipe. Right: Interior of power house showing the four original units in the foreground and the fifth unit in the background.

General Electric Company. Excitation for the new unit is provided by a 400-kw., 125-volt direct-connected exciter. The capacity of this exciter is sufficient to supply all five generators. A bank of three 5,500-kva., 460-kv. transformers connects the generating unit to the 60-kv. buses. These transformers are designed to operate in parallel with existing transformers either singly or in banks. One spare transformer unit is provided.

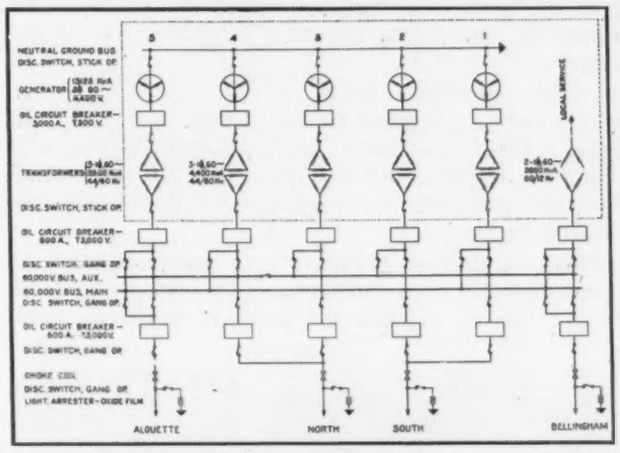


Fig. 5.—One-line wiring diagram of electrical connections. The equipment shown within the dotted lines is mounted in the outdoor switch rack.

Switching Equipment.

Standard practice is followed in the arrangement of the switching equipment. Each generator, with its transformer bank, is considered and treated as a unit, all five units being tied together on the 60-kv. buses. Between each generator and its transformer is an oil circuit breaker, type H-206, rated at 3,000 amp. and 7.5 kv., which serves for synchronizing and for isolating the generator in case of transformer trouble. Between each transformer bank and the high-tension buses is an oil circuit breaker, type FHKO-136, rated at 600 amp. and 73 kv., and two sets of bus-selector air-break switches, Pacific Electric 600 amp., 73 kv. switches. These air-break disconnecting switches are gang operated and manually controlled from the operating floor through a system of rods.

Generators are star-connected with the neutral leads brought out to provide for the installation of current transformers for differential relay protection. Neutrals are made up outside of the current transformers and are grounded solidly. Generators are protected from overspeed by an overspeed device on the shaft and by frequency relays. Each transformer bank is protected by differentially connected relays, and the generators are further protected by overcurrent relays.

In addition to the equipment necessary for the controlling of the local units and circuits, provision is made to handle the output of the Alouette plant when it is completed. The Alouette plant is to be semi-automatic and will be treated at Stave Falls as if it were a local generating unit, tied to the high-tension buses in a similar manner.

Two 60-kv. buses are installed to give the desired flexibility of operation. These are tied to the generating units as already described. Feeding from these buses are three transmission circuits. Two of these are the main feeders from the station and carry the bulk of the power to the Vancouver load center. These two lines are equipped with induction-type balanced current relays and overcurrent relays. The third circuit serves at the present time as a tie with the system of the Puget Sound Power & Light Company at Bellingham, Wash. Provision is made, however, for its ultimate use as one of a pair of lines to handle the output of the Ruskin development when that portion of the project is undertaken. Overcurrent relays also are provided on this line.

Because of the importance of the two lines first mentioned they are each equipped with an oil circuit breaker for each of the two buses at Stave Falls. The Bellingham line is equipped with only one oil circuit breaker on one bus, disconnecting switches being used for the other bus. Transmission and tie lines are equipped with choke coils and with lightning arresters of the oxide-film type.

Station light and power are provided by a bank of 60/12-kv. transformers fed from the 60-kv. bus.

Station Building and Miscellaneous.

The power house building is a reinforced concrete structure 100 ft. wide and 215 ft. long, including the addition for the fifth unit. It is located in the westerly channel of the old river and is some 200 ft. downstream from the intake dam. Foundations rest upon solid rock. In fact, the excavation of some 58,000 cu. yd. fo rock was required to prepare for the foundations. The switchboard bay extends along the east end of the building at an elevation of some 21 ft. above the generator floor. This location provides an unobstructed view of the generating floor and all of the machines and low-tension oil circuit breakers.

Fig. 6.—Flood discharge through the Blind Slough dam. The four bays at the left are controlled by Tainter radial gates. Provisions for the 16-ft. highway roadway are shown.

The main switchboard faces the gallery. In addition to the usual run of instruments this board is fitted with five eight-point graphic temperature recorders. These are arranged to indicate and to record the temperatures of the generator stator winding and the oil temperature of the corresponding transformer bank. An auxiliary board behind the main board carries the relays and the station

service control equipment. Directly beneath the gallery is the d. c. room, where the exciter output is centralized and re-distributed. Generator field rheostats also are located in this d. c. room.

Immediately in front of the station, on the downstream side, is the new 60-kv. outdoor bus and switch rack. This structure is supported on a reinforced concrete slab 68 by 160 ft. in dimension carried on piers set in the tailrace. The superstructure is of latticed steel towers and girders, is 50 by 153 ft. in plan, and has a maximum height of 62 ft.

The tailrace is excavated in the old river channel for a distance of 1,500 ft. to its junction with the main river. It is 70 ft. wide, and its construction entailed the excavation of some 22,000 cu. yd. of rock and 75,000 cu. yd. of other material. A V-shaped weir constructed to regulate the depth of the tail water is set in the channel about 100 ft. downstream from the power house wall. The normal elevation of the tail water is 210.

Efficiency.

With a plant efficiency of 78 per cent, allowing for all machine and penstock losses, the 4,200 sec.-ft. flow is capable of generating 32,000 kw. continuously, and the total annual plant output will closely approximate 280,000,000 kw-hr. This will be the condition when the Alouette plant is completed. With the fifth unit in operation the plant has an installed capacity of 65,625 kva. At 0.9 power factor the peak load capacity is 59,000 kw. Owing to the limited turbine capacity, however, it is believed that a peak capacity of not greater than 54,000 kw. will be the average under conditions of average head. Thus the plant can operate on an average annual load factor of 59.1 per cent. The load factor of the system approximates 50 per cent.

Measuring Glacial Movement on Mt. Hood with Markers Located by Transit

MEASUREMENT of ice flow in the glaciers of Mt. Hood near Portland, Ore., has been begun recently by the research committee of "Mazamas," an Oregon organization of mountaineers. The plan of observation is to run lines across a glacier with a transit, mark a number of points in the ice, and then re-run the same lines from time to time measuring the movement of the marked points.

The work has been done chiefly on Eliot glacier on the north side of the mountain which, the committee states in reporting on its 1925 work in the club's annual magazine, "was selected for observation because it is a typical glacier, has most of the characteristics common to mountain glaciers and is the longest ice stream on the mountain." Lines were run this year at El. 7,800 and El. 7,200 and were re-run every three weeks for a period of nine weeks. At the higher level where the glacier is 2,400 ft. wide, 11 stakes were set, some in packed snow and others, where ice was exposed, were put in holes drilled in the ice by hand with an ordinary rock drill bit welded to the end of a length of iron pipe.

"A most noticeable feature," the committee states, "was the rapid melting of the ice in the central part of the glacier. About one foot per week of solid ice melted during the first six weeks of observation. During the second period of three weeks several stakes that had been sunk 4 ft. into the solid ice had melted out and fallen down. This melting of the ice constitutes our greatest problem in measuring the flow. It is very hard work to drill the holes, the vigorous effort of two men for about an hour being required to drill a hole 4 ft. deep.

"The committee tried several kinds of drill points but has reached no conclusion as to the best type. After the holes were started, water was poured in to float out the ice chips. It was found that the presence of water greatly facilitated the drilling.

"The committee plans to try various types of metal plates as ice markers. The problem will be to get one of suitable thickness to transmit such an amount of heat to the ice beneath that it will melt at the same rate as the surrounding surface. At the same time the marker must be of sufficient weight to not blow away."

Measuring glacial flow on Mt. Hood. Dotted line from the transit indicates initial position of stakes. Locations indicated by circled figures show later positions of same points.

The maximum movement of ice observed was about two-thirds the way across from the southeasterly side of the glacier, where there was a uniform flow of about 7½ in. daily during the nine-week period when observations were possible. From this maximum the movement decreased to a minimum in the stake nearest the edge, which moved 1¾ in. daily in the first period, 2¼ in. in the next period, and 1 in. in the third period, this movement corresponding to some extent to temperatures prevalent during these periods.

Measurements were continued into the fall until snow prevented further observation. The markers were anchored well for the winter so they can be located next spring to determine the amount of winter flow. It is proposed to initiate next season similar observations on other of the more accessible glaciers on the mountain.

Advantages of Unit-Drive System Shown in Reorganized Factory

WITH the development of the unit-drive system by electric motors for large industrial installations, a new market has been opened for the services of power companies, motor manufacturers, electrical engineers and contractors. Co-operation between these groups has been developed to a high degree, and the entire industrial field in the West is being canvassed. One outstanding reorganization was completed recently in the Oakland factory of the Fageol Motors Company. The details of this installation are described in this article.

POWER companies, motor manufacturers, electrical engineers and contractors are finding a great market for their services and products in plants equipped with overhead drive systems of power distribution. Many such plants were constructed before the production of electric power had reached its present large proportions. There was no widespread and organized effort to acquaint manufacturers with the advantages of the unit-drive system by electric motors. Today the large power companies and manufacturers of electrical equipment have elaborate campaigns functioning for the development of industrial power business. Co-operation with the efforts of electrical engineers and dealers in motors and other supplies has been developed to a high degree, with the result that the entire industrial field in the West now is being canvassed thoroughly.

The fact that large and important concerns will scrap an existing overhead system and replace it with a motor for each machine is perhaps the most conclusive proof of the advantages of the unit system which can be cited. Such results can be secured, of course, only in fields where the benefits to be derived are many, and it is on that basis that the unit drive is gaining ground.

Economy of power is undoubtedly the point of greatest interest which the proponents of the individual motor drive can advance to a manufacturer. It is one which registers quickly, too, for one look at a ceiling of idly turning shafting, spinning pulleys and whizzing belts discovers volumes in favor of motors connected to each machine by direct attachment, gears or a short belt or chain. The labor saved by eliminating the need of oiling and keeping up long lines of shafting is also an important item.

Careful attention to spotting machines, according to the normal path of production, also has developed one of the great advantages of the unit-drive method. The flexibility of this method adapts it readily to even the most erratic demands along that line.

Further impetus has been given to the development of unit-drive systems by the inauguration of safety laws and campaigns along that line. Even an extensive outlay for protective devices will not entirely safeguard all the employees in a plant operated with an overhead drive. The psychological effect alone of being surrounded on all sides and overhead by a network of fast-moving and noisy objects is a detriment to the health of workers and a brake upon production. Slower movements are the natural result of fear, even though it is a sensation of which a man may not be conscious.

The unit-drive also scores from the standpoint of improved lighting. The amount of light which is cut off by shafts, belts and pulleys can be visualized only by a comparison of similar plants under the opposite methods of supplying power to the machines. This may be seen in Figs. 1 and 2. Since the speed of production, amount of spoilage, safety and general efficiency are influenced largely by the lighting, any improvement to be secured by individual motors at each machine is worth considering.

All of the factors which enter into a comparison of overhead and unit-drive systems have been worked out and may be seen in actual practice in the Oakland factory of the Fageol Motors Company. Increased production facilities became necessary, and last year in doubling the capacity of the factory, most of which was built when the company was incorporated in 1916, consideration was given to the merits of the motor-drive plan.

The plans for the expansion of the Fageol factory called for the rehousing of practically every department except the machine shop. In some cases this involved the erection of a new building around machines which were to continue production without changing their location. In other instances entire departments were to be placed in new quarters in another part of the plant. The machine shop only was to remain undisturbed, and there only, it was decided, would the old overhead drive system be allowed to remain. For the balance of the factory specifications for a complete electrical power and lighting system were incorporated in the plans.

Not a power line will show above ground when the work of the electrical contractor is completed. Lead conduits will bring the current from the high

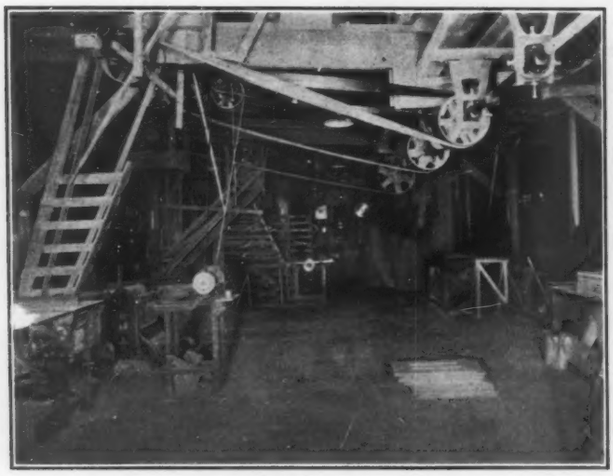


Fig. 1.—Cabinet shop before unit-drive system was installed, showing overhead system of pulleys and belts.

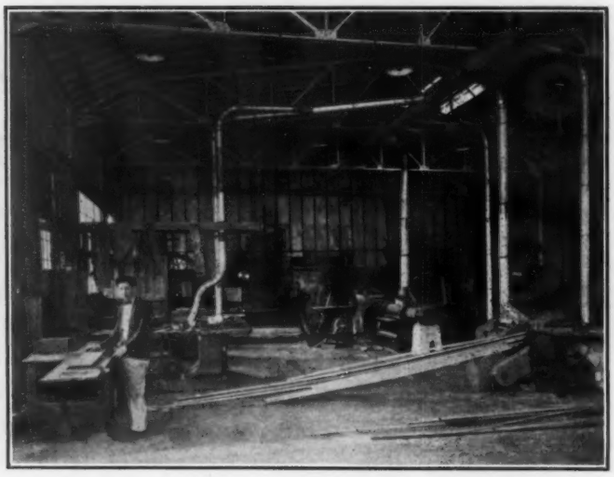


Fig. 2.—Cabinet shop after the unit-drive system was installed. Note the improved lighting system.

line into the new transformer vault and distribute it from there throughout the Fageol factory beneath the surface of the ground. Conduits in the concrete floors of the new buildings carry the lines direct to the machines to be served. The overhead space in every shop will be absolutely clear.

Three 100-kw. transformers in the vault step the 2,300-volt power brought in from the street down to 440 volts. Two leads run from each transformer, closing the delta right at the board, instead of using three leads to the delta. The whole installation is arranged so that the 100-kw. transformers may be replaced later with 200-kw. transformers without changing the wiring. As the vault will be kept under lock and key, open bus bars have been used overhead instead of heavy wires in a gutter to facilitate changes. These are shown in Fig. 5.

On the outside of each building a transformer has been placed to step down the power current for the lighting circuits. J. W. De Cou, factory superintendent, cites the lighting system as his especial pride, particularly the unit-control feature; that is, the placing of switches upon the pillars nearest the lights which it is desired to control. Formerly the switches all were grouped at the fuse box, and men repeatedly would turn on and off half the lights in a building in their efforts to control the group lighting their work. By proper spacing of lamps and the use of reflectors an even light has been secured throughout the new buildings. "I have gone all through every shop with a barrel open on one end," Mr. De Cou states, "and have been unable to find any spot where I might set the barrel up so that its side would cast a shadow over the bottom. When a lighting system can pass a test like that you may be certain that your men will never be handicapped by the necessity of going about their work blindly in the shadow cast by their hands."

Another interesting feature is the auxiliary light on a flexible arm placed on certain machines where a close light right on the work is needed. It takes current from the power wire through a small transformer on the machine. Thus it is possible to have the light turned on only while the motor is running, and the wastage, which is common in most plants as a result of men turning on such lights and going off leaving them on, is avoided. Fig. 9 shows one of these installed on the quick-work former.

Power for the machines in each department is

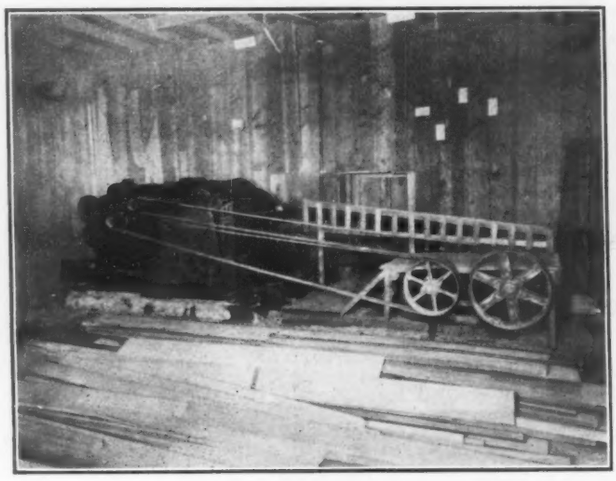


Fig. 3.—Cumbersome belt-drive connected to planer in old installation.

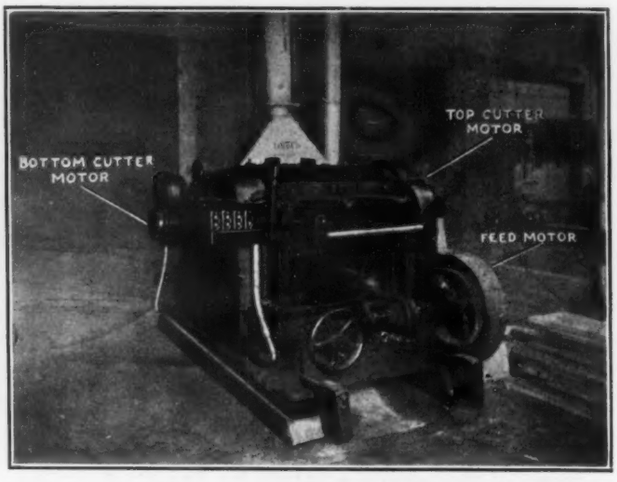


Fig. 4.—The motor was made an integral part of the new planer.

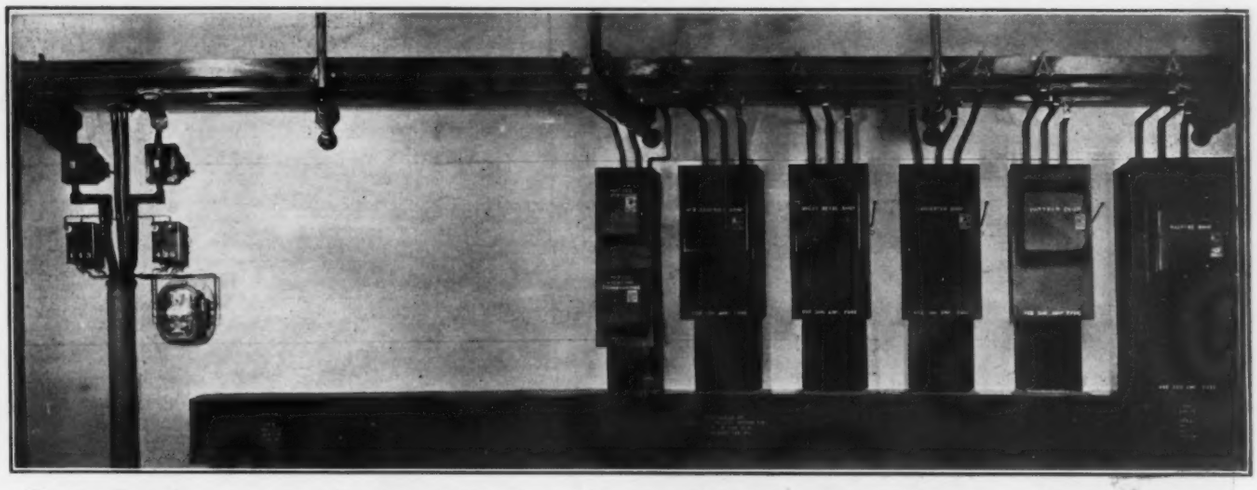


Fig. 5.—Transformer room and main switchboard. As this room is locked, open bus bars were used overhead instead of heavy wires in a gutter in order to facilitate changes.

distributed through a central control board and controlled by push buttons placed conveniently at the operating positions. In adapting this system and individual motor-drive to the various pieces of machinery, many problems were encountered which had to be solved by special engineering worked out right on the job. A number of typical instances will be cited.

On the large planer provision had to be made for the removal of the knives for sharpening. For that reason it was necessary to mount the motor on the machine and make it an integral part of the planer. The desired result was accomplished by tearing down the whole motor, removing the bearing at one end, and mounting the whole thing on the shaft of the planer.

The pony planer was seldom used when belt-driven, because the belts used to slip and trim the boards in wavy lines. Now, with two motors operating it, one feeding and one driving, it is a very popular machine and does fine work. A quick-work former also was laid out for two motors because it had to operate in two directions under control of two foot pedals. But one motor and two clutches, one working on a gear and the other on a silent chain, solved that problem.

One of the most complicated machines to be adapted to the unit-drive system was a sander. Three motions or directions had to be given to the drum—up and down, endwise and revolving. Double thermoid couplings spaced twelve inches apart allowed for the up-and-down motion. Then the rotor shoulder was turned back on the shaft so the rotor could oscillate in the bearing and permit the motor to swing free in the stator to take care of the endwise motion while at the same time providing the rotary motion, of course.

Kick-button control on drills; three motors on a surfacer, each with an individual control push button, but an emergency stop button controlling all three; and three-phase motors on bench drills instead of single-phase, thus providing more constant and dependable driving power, are other interesting features in the Fageol plant which go to show that modern ingenuity can meet practically any conditions.

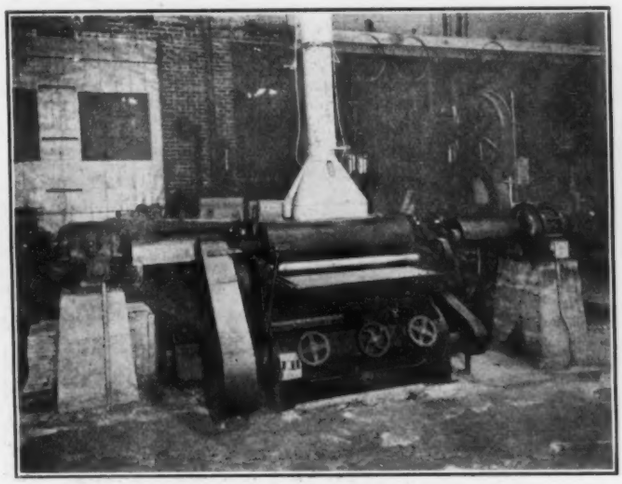


Fig. 6.—The sander was one of the most complicated machines to be adapted to the unit-drive system in that three motions or directions had to be given the drum—up-and-down, endwise and revolving.

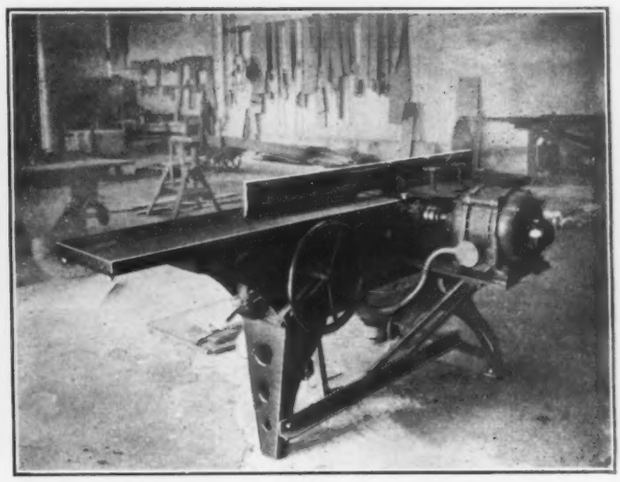


Fig. 7.—The pony planer was seldom used when belt-driven because the belts used to slip and trim the boards in wavy lines. Now with two motors operating it, one feeding and one driving, it works well.

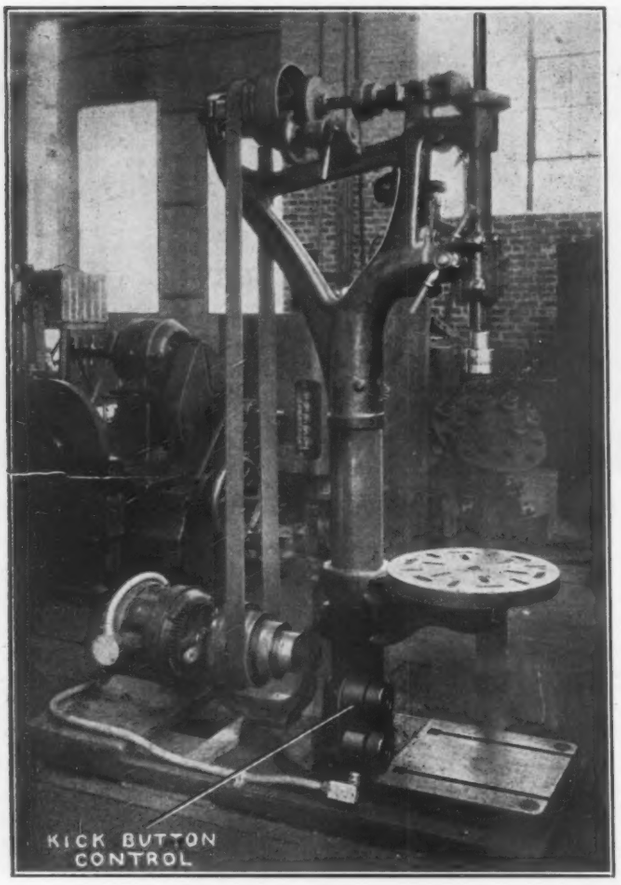


Fig. 8.—Drill press with kick-button control.

To handle this work it was necessary for the electrical contractor to maintain a force at the Fageol factory throughout 1925 and vary its size according to the progress being made on the new buildings and the work required of different departments. This installation was made by the Pacific Electric Motor Company of Oakland.

Although no figures are available showing the power factor with the overhead drive system as compared with the unit-drive system, it is thought that this would be considerably higher with the unit-drive system. This would be due to the fact that a motor driving a line shaft would be only partially loaded a great deal of the time; when this is true the power factor is low. With the unit-drive system each motor would be operating at more nearly full load with a resulting higher power factor.

In studying the relative merits of group versus individual motor drive one of the most important considerations is the question of power consumption and first cost. Individual motor drive also results in maximum freedom from obstruction and has other advantages that contribute to operating flexibility and economy of power, especially when part of the plant is run overtime.

In April, 1925, the demand at this factory was 126 kw. or 168.9 hp., with a monthly consumption of 23,040 kw-hr. At this time there was a connected load of 239.8 hp. In November the demand was 131.4 kw., or 176.1 hp., with a consumption of 25,680 kw-hr., when 484.5 hp. was connected. The installation was not completed at this time and a considerably larger load now is connected. Part of the load was operating with the overhead drive and part with the unit-drive.

Table I.—Operating Data of the Fageol Motors Company.

Month	Demand		Kw-hr.	Hp. Connected
	Kw.	Hp.		
April, 1925	126.	168.9	23,040	239.8
May, 1925	126.	168.9	25,920	
June, 1925	147.6	197.9	32,880	
July, 1925	133.2	178.6	34,560	368.8
August, 1925	129.6	173.7	27,120	
Sept., 1925	118.8	159.2	23,040	
October, 1925	115.2	154.4	18,000	
Nov., 1925	131.4	176.1	25,680	484.5
Dec., 1925	151.2	202.7	28,560	
Jan., 1926	162.	217.2	27,360	

However, these figures may be taken as an indication of the results that may be expected with a transformation from the overhead to the unit-drive in installations of this type. The connected load may be increased considerably without proportionately increasing the demand factor or the total kw-hr. consumed. As in this case with the connected load doubled, the demand was increased only 4.3 per cent, and the kilowatt-hours consumed were increased only 11.5 per cent.

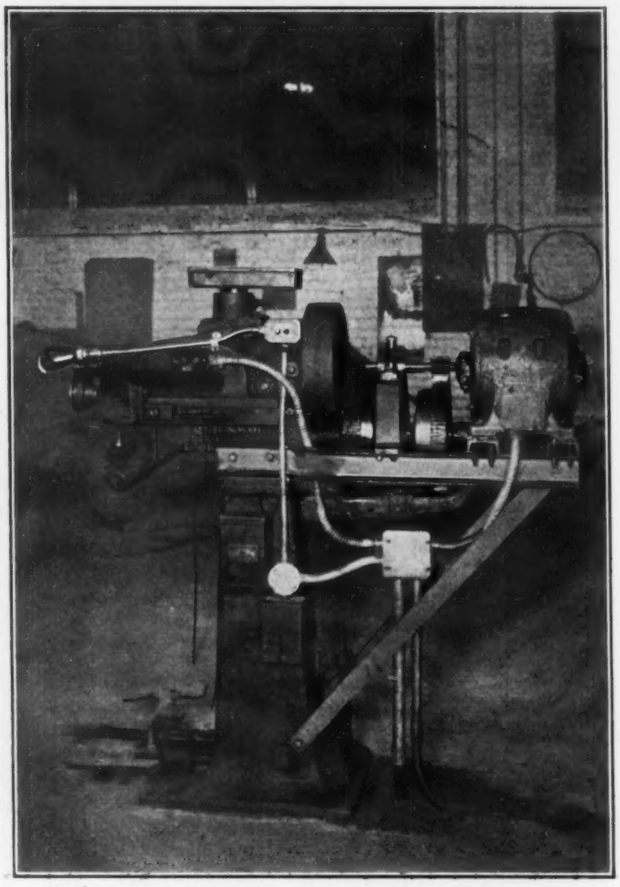


Fig. 9.—Quick work former showing an auxiliary lamp on a flexible arm.

Tests on Steel and Wood Poles*
Part 2—Wood Poles

A series of tests was made of the strength of wood poles on March 17 and 18, 1925, at the Davis construction yard of the Pacific Gas and Electric Company. These tests were made at the same time as the tests of steel poles were made. The results of the tests of steel poles were given in Part I of this report.

The poles tested were of varying lengths and ages. However, all of them were Washington or Oregon red cedar, with but two exceptions. These latter two poles were full-length creosoted fir. A total of 14 wood poles were erected for tests and 10 of them actually tested.

Two purposes are in view in the making of this report:

1—To establish as far as possible the relative strength of cedar, fir and pine poles, new poles as well as those that have been in service for a number of years.

2—To continue the study of methods of and materials for the preservation of wood poles of all kinds.

Description of Tests

Pulls were made horizontally and at a point six in. from the top of the pole in all cases except one. That one test was made from the end of an 8-ft. crossarm placed 4 ft. 6 in. from the top of the pole, thus making the point of attachment approximately 3 ft. 6 in. from the center of the pole. This test was made on a full-length-treated red fir pole.

The strength of poles varied from 1,750 lb. for the older cedar poles to 3,250 lb. and upward for the new red fir poles. As will be noted in Table VIII no failures occurred in the test of the red fir poles and no failures on the shorter length red cedar poles. In many cases the softness of the ground permitted the pole to change its position in the ground to such an extent that further testing was useless. When this happened the pull produced tension in as well as bending of the pole and the final results obtained are of little value as far as the actual strength of the timber is concerned.

All holes were dug by the earth-boring machine of the Pacific Gas and Electric Company and had a minimum diameter of 18 in. Holes were dug 5 ft. 6 in. in depth for 35-ft. poles and 6 in. deeper for each additional 5 ft. length of pole. When poles were placed earth was replaced and tamped carefully, restoring it as nearly as possible to normal conditions, and the poles allowed to stand for 10 to 12 days before the final tests were made. The ground was heavy alluvial soil and quite damp. The movement of the poles in the earth would compare quite closely with conditions under normal winter weather after heavy rains, but would not represent the conditions that would exist during the dry summer weather when the earth becomes quite hard.

Test rigging was the same as that used in making the tests on the latticed steel poles, described in Section 1 of this report.

Deflections of the top of the pole were measured by means of a rope carried to the double-pole test structure and over a pulley to a suspended weight. The movement of the weight gave a direct indication of the deflection. The ground line deflections and deflection angles were read with a transit by noting the horizontal movement of one nail set at the ground line and another set 2 ft. above.

Wood Pole Preservation

To the user of wood poles the question of preservative treatment is of vital importance. It means the buying of fewer poles; less trouble after they are set in lines; and fewer replacements with the resultant expense, inconvenience and impaired service.

In most instances the life of a wood pole is determined by its life at and below the ground line. The number of years a pole is useful varies in different soils and under different conditions. The Pacific Gas and Electric Company has untreated poles which have been in service from 15 to 20 years and now are in better condition below the ground line than at the top. However, these conditions are the exception. Table IX gives a comparison of the length of life of different woods in the ground.

The normal life of wood can be estimated only in the broadest terms for obvious reasons. Some woods naturally are more durable than others and last longer under similar service conditions. Even the durable woods sometimes give out in a relatively short time if they are exposed to particularly unfavorable conditions. Wood that is kept dry will last for years and wood that is kept thoroughly wet also will lost for years. In other words the kind of wood, the kind of service and the conditions of service determine the period of use which reasonably may be expected.

Economy is effected by preservative treatment whenever the annual charge against the treated timber is less than the annual charge against any untreated timber which would serve the same purpose.

*Serial report of poles subcommittee of the overhead systems committee, P.C.E.A. (Prepared by 1924-5 subcommittee, but publication delayed.) Subcommittee personnel as given with Part I in the Feb. 15 issue of the Journal of Electricity.

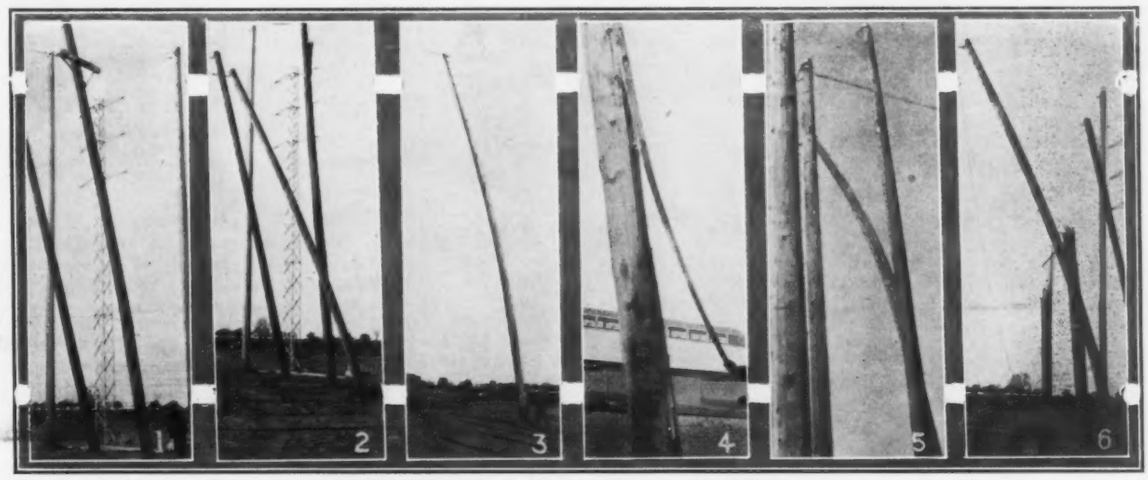


Fig. 8.—(1) 2,500-lb. pull on cross-arm, new full-length-treated red fir pole. (2) 2,000-lb. pull on new butt-treated cedar pole. (3) 2,500-lb. pull on new butt-treated cedar pole. (4) Break at 2,800-lb. pull on new butt-treated cedar pole. (5) Crack at 2,120-lb. pull on salvaged cedar pole 8 years old. (6) 2,800-lb. pull on salvaged cedar pole 9 years old.

The annual charge (r) can be computed from the formula:

$$r = \frac{PR\,(1+P)^n}{(1+P)^n - 1}$$

where R = Initial expenditure, P = rate of interest in per cent divided by 100 (usually 0.05), n = life in years. This considers an annual charge sufficient to pay the interest on the first cost of the pole plus a balance which, with interest compounded annually, will provide a fund at the end of n years equal to the first cost.

Treatments and Preservatives

The most common methods of pole treatments with preservatives are: 1—Brush treatment. 2—Open-tank treatment with either a hot solution or a cold solution. 3—Pressure treatment with either the full-cell process (12-lb. treatment) or the empty-cell process (8-lb. treatment).

A brief discussion of several preservatives is given in the following paragraphs:

Zinc Chloride—Tests have shown that up to the present time creosote is the best preservative. Other preservatives have been tried in the past. Zinc chloride is a valuable preservative but attacks the metal walls of the treating plants and also leaches out. A new zinc-chloride process has been developed recently that uses the pressure method in one operation. In this case an emulsion of zinc chloride with petroleum oil is used. The object of the petroleum oil in conjunction with the zinc chloride is to weatherproof the timber so treated.

Basilit—This is another valuable preservative. It can be used only in cold solution.

Wolman Salts—This compound is a wood preservative developed in Germany and which came into general use in central Europe between 1902 and 1908. It has been introduced just recently into this country by the American Wood Impregnation Company of New York under the trade names of Minolith, Triolith and Tanalith. This company expects to extend plant operations to the Pacific Coast very soon. Minolith in ad-

TABLE VIII.

Test No.	Type of Pole	Age in Years	Elevation of pull point above ground	Pole Depth in Ground	Pole Diameter (Inches)		Pull-Load in Lbs.	Center-Line Deflections				Diam. of Hole dug	Deflection at end of crossarm	Remarks
					Top	Butt		At Ground	At Elev. of Pull	Angle of deflection at ground				
			(Ft.)	(Ft.)				Ft. Inches	(Ft.)	Deg.	Min.	(Inches)	(Ft.)	
2	Full length Treated Red Fir	New	42.0	7	10	14	500		1.9	0	42	24		Breast pull only applied. Pole appeared sound. 50 ft. pole.
							1,250	2¼	4.6	2	47			
							1,750	5⅜	7.7	5	32			
							2,250	8½	10.6	8	59			
							2,750	1 0¾	14.6	13	27			Pole showed no sign of failure. Ground gave way badly in front of pole.
							3,250	1 4⅝	18.3	17	48			
							0	1 2⅛	12.85	14	29			
3	Full length Treated Red Fir	New	38.0	7	8½	14	750		1.05	0	30	24	3.0	
							1,500	2⅛	3.5	3	05		6.9	Pull applied at end of cross arm, 13 ft. 6 in. from center line of pole.
							0	2½	1.95	2	11		2.5	
					Pull was released to re-attach hook									Crossarm was 5¾ x 5¾ in. and attached to pole by 2⅝ in. bolts 6 in. apart with 1¾ in. x 2¾ in. wood quarter-braces. Crossarm was 4 ft. 6 in. down from top of pole.
							1,500	3⅛	3.7	3	29		7.2	
							2,000	5⅛	5.0	4	53		9.2	
							2,500	8¾	7.5	8	11		12.2	
					The crossarm rotated more than 45 degrees including considerable twist of the pole in the ground.									
					The deflections at the end of the crossarm were taken by plumbob on the pull-line and are subject to error. No sign of failure in either pole or crossarm appeared. Angle-of-deflection readings at ground are subject to error due to twist of pole in ground. 50 ft. pole.									
4	Butt-treated cedar	New	33.75	6	7½	12	750	⅞	2.9	0	42	24		40 ft. pole.
							1,500	5¼	8.5	3	11			
							2,000	10⅞	11.05	14	16			
							2,200	1 0	12.85	26	37			Failure started at this point so dynamometer was disconnected and pole pulled to destruction. Pole broke at ground line.
	Butt-treated cedar	New	28.75	5	8	12	750	⅜	1.6	1	6	24		35 ft. pole.
							1,500	3¼	4.4	4	47			
							2,000	8⅜	8.3	10	55			
							2,500	1 2¾	12.0	19	17			
							2,900	1 11¼	17.0	36	10			Pole leaned over (due to ground giving) so far test was stopped.
8	Butt-treated cedar	New	51.75	8	8	20	450	⅛	1.4	0	59	24		60 ft. pole.
							950	2⅛	3.55	2	53			
							1,740	4⅛	7.3	4	21			
							2,300	8⅛	11.4	9	18			
							2,800	Not taken	16.25	Not taken				
							3,140							Broke 10 ft. to 25 ft. from ground in long splintering break.
9	Salvaged cedar	8	55.75	8.5	8	16	1,010	¾	4.2	1	12	30		65 ft. poles.
							1,850	2⅜	8.75	3	05			Top was split half way through for almost entire length. Failed by splitting in half at same place.
							2,120		Failed					
10	Salvaged cedar	8	56.5	8.5	10	16	1,075	⅞	5.5	0	54	24		65 ft. pole.
							1,850	4	10.7	4	11			
							2,440	7	15.1	6	47			Failed 1 to 9 ft. above ground by splintering of outside sap wood leaving sound center. Pull was continued. Pole snapped off 25 ft. above ground.
							2,950	Not taken	21.1	Not taken				
							3,050	Not taken		Not taken				
11	Salvaged cedar	9	42.75	7	9½	15	1,100	¾	3.2	1	23	24		50 ft. pole.
							1,550	1⅞	5.6	2	48			
							2,000	5⅞	10.0	6	11			
							2,500	9¾	14.1	9	36			
							2,800	11¾	16.3	11	13			Failure started and had slacked off with no sign of failure externally. Dynamometer was disconnected and pole pulled over, breaking 6 ft. 6 in. above ground. Break was sharp, but pole was shattered above for 10 ft.
12	Salvaged cedar	9	42.5	7	8	17	750	⅛	2.15	0	42	24		50 ft. pole.
							1,500	2¼	5.15	3	11			Pulled over so far in ground that further testing was considered useless. Pole uninjured.
							2,000	1 1	10.0	14	16			
							2,500	1 10⅝	18.85	26	37			
13	Salvaged cedar	23	29.0	5.25	9	15	750	½	1.45	1	05	24		35 ft. pole.
							1,500	4⅝	4.85	5	57			Pole pulled over so far in ground that further testing was abandoned. Pole uninjured.
							2,000	11⅞	10.45	15	30			
							2,500	1 6	14.95	24	24			

dition to its wood-preservative qualities is highly fire-resistant and is used for the preservation of mine timbers, building materials, fence posts, or wherever a high degree of fire retardation is desired. Triolith is used for railway ties, poles and crossarms. Tanalith, in addition to its preservative ingredients, has an admixture of poison salts for the additional protection of wood against fungi and animal destroyers

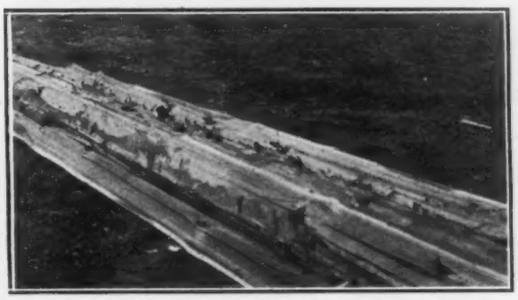


Fig. 7.—Cedar pole 8 years old; failed at 2,120 lb.

such as termites, wood worms and bore worms. These salts also contain dinitrophenol the same preservative used in creosote.

The full-cell process generally is used with this treatment and it is applied preferably to well-seasoned timber. About 1.8 per cent solution by weight is used. This is about 1 lb. of the salts to 60 lb. of water.

Service records show very favorable results in the use of Wolman salts as a wood preservative. Mining timber treated as far back as 1904 still is well preserved under unfavorable conditions. The advantages claimed for these salts are: 1—Highly toxic and preservative against all known fungi. 2—No reaction upon iron. 3—Thorough treatment throughout. 4—Clean and odorless. 5—Increases wood strength. 6—Can be painted over easily. 7—Wood can be cut after treatment without exposing untreated surface. 8—Will not leach out. 9—Fire retardant. 10—No change in present treating plants. 11—Cheap.

Table X gives a comparison of costs of creosote and Wolman salts for treating one cubic foot of wood.

TABLE IX.—Estimated life of railway crossties in place

Kind of Tie	Estimated Life in Years	
	Untreated	10 lb. Creosote per Cu. Ft.
Redwood	12	..
Cedar	11	..
Cypress	10	..
White Oak	8	..
Longleaf Pine	7	20
Douglas Fir	7	15
Western Larch	7	15
Tamarack	5	15
Hemlock	5	15
Chestnut	5	20
Red Oak	4	12
Beech	4	20
Birch	4	20
Maple	4	18
Lodgepole Pine	4	15
Western Pine	4	15
Loblolly Pine	3	15
Red Gum	3	16

Conductivity of Treated Poles

Several tests to determine the conductivity of wood poles were made recently by the Pacific Gas and Electric Company in its San Francisco test bureau. The purpose of these tests was to determine the relative conductivity of an untreated pole and a creosote-treated pole. Two ten-foot poles were used for this conductivity experiment. The untreated pole had an average diameter of 5¼ in. and the other an average diameter of 6⅜ in. The average creosote penetration on the treated pole was 1¼ in.

Contacts or electrodes were formed by driving eight twenty-penny nails into the pole equally spaced around the circumference of the pole and driven in until their points met at the center. The heads of the nails were connected together and used as one terminal. Two more electrodes of similar construction were placed in the pole, one 3 ft. and the other 9 ft. from the first. The same arrangement and spacing were used on each pole.

Resistance was measured between these three points by means of a high-resistance measuring set. The resistance of the 3-ft. section between the terminals designated as A and B and that of the 6-ft. section between the terminals B and C were used to check the resistance found in the 9-ft. section between A and C. A known high voltage next was applied to

TABLE X.—Amount of preservative for treating one cubic foot of wood pole by using Creosote and Wolman Salts

Kind of Preservative	Pounds of Preservative Per Cu. Ft. of Wood	Gallons of Preservative Per Cu. Ft. of Wood
Creosote (Full Cell or 12-lb. Treatment)	12	1.381
Creosote (Empty Cell or 8-lb. Treatment)	8	0.922
Wolman Salts Solution	12	1.4

Creosote ranges in price from 15 cents to 20 cents per gallon.
Wolman Salts cost 25 cents per lb. for the 1.8 per cent solution used.

the 9-ft. length of each pole and the current measured through a Siemens-Halske 500/1 current transformer. This transformer had a primary full-load current of one milliamp. and a secondary or meter current of 0.5 amp. After these tests the two poles were buried in moist soil for a period of 20 days. They then were excavated and the resistance was again measured.

Results of the tests are given in Tables XI and XII. The resistance of the dry untreated pole was approximately 12 megohms per ft., whereas the creosote-impregnated pole gave a resistance of only 0.55 megohms per ft.

TABLE XI.—Electrical resistance of treated and untreated wood poles

Section	Resistance, in Megohms	
	Untreated Pole	Treated Pole
Resistance (when dry)		
A to B	44.1	4.9
B to C	73.4	.54
C to A	113.4	5.26
Resistance (after twenty day burial)		
A to B	.14	.38
B to C	.33	.05
C to A	.47	.43

After these poles were permitted to absorb a large quantity of moisture by being buried in moist soil the resistance fell to practically 0.05 megohm per ft. in each pole. Treatment apparently made no difference when the poles were damp.

Resistance measurements of the treated pole as measured with high-voltage a.c. checked very closely the values found by the use of the high-resistance measuring apparatus. However, the readings on the untreated pole were higher with the a.c. than the d.c.

TABLE XII.—Current in treated and untreated wood poles at high potential

E. M. F.	Current in Milliamperes		R, in Megohms
	Treated Poles	Untreated Poles	
2,000	0.4	...	5
3,000	0.6	...	5
4,000	0.8	...	5
5,000	1.0	...	5.05
50,000	...	0.3	166.5
63,000	...	0.4	157.0
75,300	...	0.5	150.0
89,000	...	0.6	140.0
99,000	...	0.7	141.0

readings. This probably was due to the decomposition of the wood around the electrodes as a result of the comparatively high current forced through the pole by the high a.c. voltage.

Suggestions

It was impossible to secure sufficient information or to make any actual observations as to the results obtained through the Wolman-salts process of timber preservation or to form any conclusions as to its definite values as a direct competitor of the creosote treatment. However, it is believed that this preparation has sufficient merit to keep it on the live list for the work of a future subcommittee.

CENTRAL STATION CONSTRUCTION OPERATION AND MAINTENANCE

Power Company Communication Systems—III (b)

Careful Co-ordination of Telephone-Line and Power-Line Transpositions Removes One Trouble Source

By H. N. Kalb,* Superintendent of Transmission and Communication, San Joaquin Light & Power Corporation, Fresno, Calif.

In view of the foregoing discussions the important part that leakage plays in good line service now should be well understood. At this point it is well to point out that in effect the insulator, wooden pin and wood pole are but three resistances in series between the conductor and ground. However, the pin and the pole each have less resistance when wet than when dry. Thus it is necessary to figure on each of these being of but low resistance and to depend upon the insulator resistance alone.

If 2-kv. insulators are placed on one wire of a telephone line and 60-kv. insulators are placed on the other wire of the same circuit, where the total length of line is perhaps 100 miles, there would be great unbalance in the circuit due to the unequal leakage. This is an exaggerated condition and is cited as an illustration that is fairly obvious. However, if pony glass insulators are placed on one wire of a circuit and 2-kv. porcelain insulators are placed on the other wire of the same circuit the result also will be an unbalance of harmful proportions.

If conditions arise wherein it is unavoidable to use dissimilar insulators on a telephone line, it is essential that all of the insulators on both conductors of any one circuit be the same on any one pole or structure. In other words, under the conditions specified, where part of the insulators might be of glass and part of porcelain, use the glass insulators on one pole and the porcelain insulators on the next pole, and so on. This will keep the leakage to ground from each conductor balanced even though it is not uniform along the length of the line.

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Joints and splices must be good and they should be uniform. By a "good joint" is meant one that is mechanically strong and solid, giving a firm contact between wires and having a conductivity equal to that of the line wire itself. By "uniform" is meant that all joints should be alike in their size, length and conductivity. These conditions can be met best by the use of sleeves in the making of splices. If in the making of splices the wires are inserted into the sleeves until the tips of the wires are flush with the ends of the sleeves it is possible to test each joint wtih a definite pull. If the practice is followed of allowing the wires to protrude through the sleeves and then bending these ends back over the sleeves, a pull test will throw all of the strain on the sleeve itself and will give no indication of the quality of the joint. In the former case a pull on the joint throws the entire strain on the friction-hold of the sleeves and will show up any poor joints. Jumpers at dead-ends often are a source of trouble due to loose serving. These connections also should be watched.

Balanced exposure of telephone wires to adjacent power wires has been mentioned several times earlier in this treatise; that is, the two conductors of the telephone circuit so placed that they each receive the same amount of both electromagnetic and electrostatic induction. It is obvious that if both wires could occupy exactly the same space at the same instant the problem would be solved automatically. This being impossible, the next best thing to do is to interchange the position of the wires. This is effected by transpositions. Proper transposing of a communication line is one

Fig. 22.—Leeds & Northrup testing set for use in routine maintenance of telephone equipment.

of the most important factors bearing upon good speech transmission results.

Transpositions in telephone circuits carried on power-line poles never should be farther apart than about 2,000 ft. for lines of 30 kv. and above and not over a half mile apart for lines of 10 kv. or lower. They may have to be as close as 600 or 700 ft. in some instances in order to co-ordinate properly with power circuit transpositions. Proper co-ordination between telephone and power circuits is essential in all cases for the best results. Consequently the telephone transpositions must be laid out to co-ordinate with the future as well as

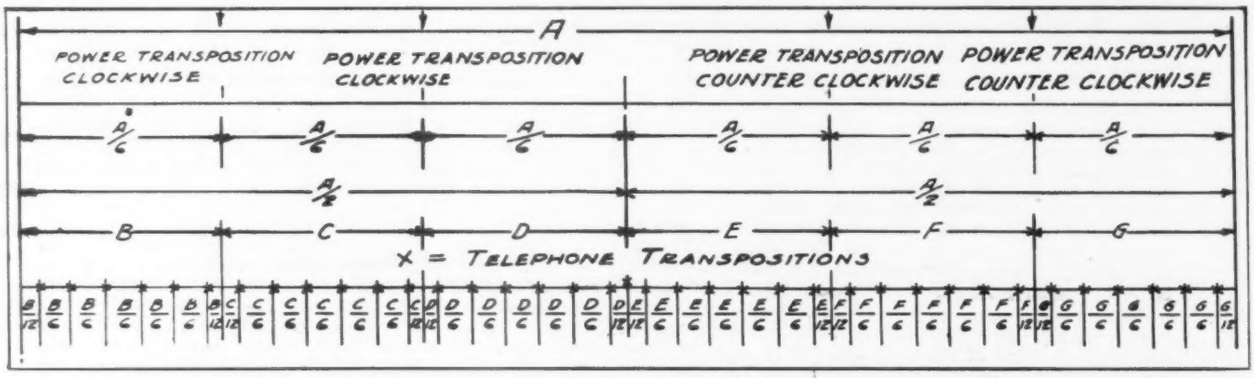


Fig. 23.--Transposition scheme for both power and telephone wires. The system is described in detail in the accompanying text.

with the present arrangements of power circuits as far as is possible. If the power wires are not transposed already the proper locations for the power transpositions should be determined. Then each transposition barrel in the power wires will be divided into three equal sections. These ⅓-sections then should be divided into an even number of parts, such as ½, ¼, 1/6, ⅛, or 1/10 as the case may be. The length of each of these subsections should be about 1,600 ft., if possible.

A co-ordination scheme for transposing both power and telephone wires where there are but two barrels in the power wires is shown in Fig. 23. Each ⅓ of the power barrel is considered as one complete telephone transposition section. This section is divided into transposition spans which in this case happen to number six. The first telephone transposition is placed not 1/6, but 1/12 of the transposition section, from the beginning, and the next and succeeding transpositions are each 1/6 of the transposition section further along the line. This places the last one in the section a distance of 1/12 of a transposition from the end of the section. No telephone transposition is placed at the end of this section as that is where the power wires transpose. However, as shown, at the junction of the two power barrels, one of which is clockwise and the other of which is counter-clockwise, there is no power transposition, and at this point the telephone wires should be transposed. A diagram showing all three of the power-circuit wires and the two telephone-circuit wires, together with all of the transpositions, will indicate clearly that each telephone wire is exposed equally to all power wires and that all power wires are exposed equally to the telephone wires. This condition gives the balanced or equal exposure mentioned previously in this article.

Even after a telephone line has been well balanced with respect to exposure, resistance and insulation, cases of trouble still are bound to occur. To facilitate the locating of these cases some provision should be made for opening the line at various points without necessitating the cutting of the wires. The contacts on such a device should be firm and of large contact area and should be protected from dust and dirt. A good 2-kv. primary cut-out is very good for this purpose, but the plug must be coppered in solid with the same size and kind of wire as the line wires, with the exception that it should be soft-drawn. However, it should be unnecessary to install such cut-outs closer together than 10 miles as each one is just another weak point in the line.

Inspection of a line that has been in service for many years may show that the line wires have been repaired a number of times and that other than standard sizes of wire and splices have been used. This condition will give an unbalance due to resistance differences and may be located with a bridge or resistance meter. By shorting and grounding the line at the far end and subsequently at numerous intermediate points and in each case measuring the resistance of each wire to ground, the cause and location of the unbalance can be determined easily. When looking for telephone line troubles it always should be remembered that the trouble may be caused from the power circuit. The power circuit itself may have a case of trouble such as loose ties, bad insulation, burnt line wires, broken bonds, or other difficulties that later may cause a failure of the power circuit and perhaps of the telephone circuit as well. Therefore, it behooves every telephone man to watch not only his telephone lines but the power lines as well. Efforts along this line will repay greatly both the telephone and the transmission departments.

To summarize in closing: a telephone line on power poles must be kept well insulated from ground; must have a balanced leakage to ground; must have a balanced exposure to the adjacent power wires; and must have a line-resistance balance. With these virtues and with eternal vigilance telephone service should be first-class even though the lines are carried on structures in common with 70-kv. lines.

Editor's Note.—This concludes the series of articles written by Mr. Kalb and dealing with some of the more important problems incident to power-company telephone lines.

Electric Shovel Quarries Rock Cheaper Than Steam

By HAZEN G. REDFERN,
Manager Dinuba District, San Joaquin Light & Power Corporation, Fresno, Calif.

An electric shovel has replaced the steam shovel at the Coast Rock and Gravel Company's quarry at Piedra, Fresno County, Calif. The new equipment has proved highly satisfactory in operation and has resulted in substantial savings in fuel and labor costs amounting to approximately $1,500 a month. Two men are required to operate the electric giant as compared with seven and eight men on the old steam shovel.

Greater frequency in loading and speed in swinging the load enables the new shovel to handle more rock in a day than did former shovels, despite the fact that the bucket is of smaller capacity. The broad caterpillar tread, 4 x 16 ft., permits moving the machine into any position, no anchoring being required. The steam shovel traveled on rails that required considerable labor to move. It is interesting to note that the electric shovel can be moved the full length of the quarry by the two operators in less than fifteen minutes, an operation which took an entire day with the steam equipment and required a crew of twelve men. Moving day often meant shutting down the entire plant, with idle men and machines on the payroll.

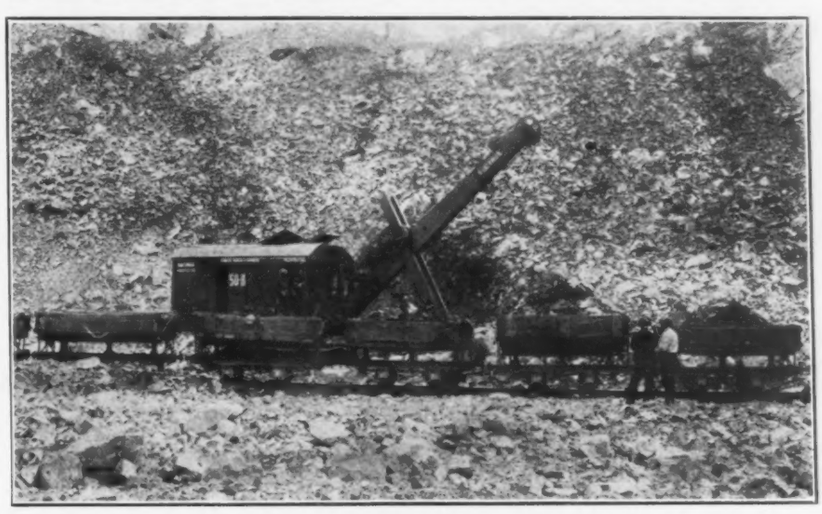
Another factor of economy is in the amount of explosive used. Formerly it was necessary to seal three or four sticks of dynamite in the rock by means of adobe mud. Now the operator swings the beam around, drills a hole in the rock, and with one-fourth of a stick obtains the same results.

Power is supplied the machine by means of a heavy and well-insulated flexible cable connected with a feeder from a substation on the hilltop. Four motors are required for the shovel, 100 hp. for hoisting and moving the machine, 40 hp. to actuate the beam vertically and 30 hp. for horizontal operation. The two air compressors are operated by a 2-hp. motor.

In addition to the shovel installation, the rock and gravel plant is completely equipped electrically with an installation of 854 hp. in motors, 490 hp. operating the six crushers, 150 hp. the bucket elevator and screeen, and 100 hp. the air compressor in the plant. The balance operates the water pumps, conveyors and shaker screens. Motors of 18 hp. additional are installed in the machine shop, operating the lathe, blast drill tool dresser, and ice-making machine.

Operation of a lift bridge on the lines of the Pennsylvania Railroad Company at a point remote from transmission lines and other sources of electric power caused that company to install two 100-kw. gas-engine-generator sets for that purpose. Two 100-hp. motors are installed at the lift span. Either motor and either generator set is capable of operating the bridge. Thus the duplicate installation insures the undelayed operation of the bridge.

Shop Foreman—"Smoking, hey?"
Erring Worker—"No, Camels."



Electric shovel used in the Coast Rock and Gravel Company's quarry at Piedra. Power to operate the four motors is transmitted from the power line on the hilltop by means of a heavy flexible cable.

IDEAS FOR THE CONTRACTOR

Electrical Estimating for the Contractor—VIII

Belt and Pulley Problems with Which a Contractor in the Power Installation Field Should Be Familiar

By J. R. WILSON,* Engineering Department, Los Angeles Electric Works

The electrical estimator who specializes on power-installation work occupies a unique position in the electrical field. Most of his prospects, particularly the one which would be termed the small-job customer, expect him to function in several capacities. They feel that he should be an electrical engineer, mechanical engineer, ventilating engineer, illumination expert and millwright.

In order to satsfy this class of customer an estimator really must be able to function to a small degree in each of the above capacities; otherwise the customer feels that the estimator does not know his business. The problems to be met in the usual small job are not of great enough magnitude to require a complete knowledge of any of the above professions. A few tables and formulas pertaining to each of these lines of endeavor are all that is necessary.

An estimator should carry these reference data with him and not attempt to memorize them. He will find that very few of these problems will offer any difficulty if he has the right data and knows where to find what he needs. In an endeavor to offer some assistance to the estimator who has not had the advantage of a diversified experience in this class of work the next few sections of this estimating series will be devoted to this type of data. Tables and formulas will be presented with examples of their practical application.

Millwright work represents the greatest number of problems met with; therefore we will consider this phase first. A fair knowledge of belts and their application must be acquired before much progress can be made in solving mill-wrighting problems.

If a belt is to transmit effective power there must be more tension in one side than in the other. The difference in tension between the two sides is called the effective tension. To determine the proper belt to use for each installation several factors must be considered. Among these are conditions of use, load belt will be expected to carry, and money available. It is very poor economy to buy a belt of too light weight or to buy a cheap grade of belt, as the deterioration will be very great.

A good belt should stand 25 per cent overload for short periods of time without ill effect. A belt larger than indicated by the apparent load is one of the best investments that can be made. The life of the installation is dependent upon the quality of the belt used and break-downs are the most expensive items of plant operation.

Accompanying this article is a number of rules and tables pertaining to belts, with examples of their use. Originality is not claimed for these data, but most of them have been tested in everyday use and have proved of great assistance in solving belting problems.

The first rule to be learned in laying out line shafting and belt drives is to make the distance between the shaft centers as great as possible with the space available. The effective power transmitted by a belt is represented by the arc of contact on the smaller pulley. Where the difference in size between the two pulleys is considerable the arc of contact may be very small. This will result in considerable slip, and the amount of this slip represents the power lost in transmission. The arc of contact on the smaller pulley should never be less than 155 deg. and standard practice has shown that 165 deg. as a minimum is much better.

The belt should be run as slack as possible, and arcs of contact less than those recommended above will necessitate running the belt at too high tension. The ideal horizontal drive is with the belt pull on the bottom and enough distance between shaft centers that the weight of the belt gives at least 180 deg. arc of contact on the smaller pulley.

TABLE 1

Arc of Contact on the Smaller Pulley

$$R = \frac{\text{Dif. in diam. of pulleys in in.}}{\text{Center distance in ft.}}$$

R	Arc of Contact (Deg.)	Correction Factor
0	180	1.00
1	175	.97
2	170	.95
3	165	.92
4	160	.90
5	155	.87

The distance between shaft centers that will be necessary to give a desired arc of contact can be determined by the following formula:

Divide the difference in diameter in in. of the two pulleys by the ratio R. For value of R refer to Table 1, and choose the value opposite the arc of contact desired.

$$\frac{\text{D-d (in in.)}}{\text{R}} = \text{C.D. (in ft.)},$$

where C.D. is the shaft center distance.

After the arc of contact has been found, refer to the column which gives the amount to correct the different arcs of contact.

If the desired arc of contact requires a shaft center distance in excess of the available room, use a short center drive with one of the many belt idlers now on the market. Refer to Table 2 for list of practicable shaft center distances. Another very good formula for arc of contact is given below:

Arc of contact in degrees =
180 deg. — [60 × (D — d) + L]
D = Diam. large pulley in in.
d = diam. small pulley in in.
L = Shaft center distance in ft.

Percentage of power transmitted (based on variance from 180 deg. arc of contact on smaller pulley).

Per Cent	Deg.	Per Cent	Deg.	Per Cent	Deg.
170	97	140	87	110	75
160	94	130	83	100	70
150	91	120	79	90	65

Table 2.

Satisfactory Center Distances

Type of drive	Width of belt (in in.)	Distance between centers (in ft.)
Small C. S.	2 to 6	Approx. 10 to 12
Medium C. S.	6 to 10	Approx. 14 to 18
Large C. S.	10 and up	Approx. 18 to 25
Main	12 and up	Not over 35

C. S. = Counter Shaft.

A given belt will not transmit the amount of horsepower at which it is rated unless the type and weight are correct for that particular installation. The very best belt ever manufactured will fail if used where the conditions are not satisfactory. In order to transmit power by belting two factors are of paramount importance: pulley diameter and belt speed. Of these two factors the belt speed is of the most importance as the heating effect on the belt depends upon how many times per minute the belt is bent around the pulley. It is self-evident that a slow-speed drive will prove more satisfactory over small pulleys than the same belt run at higher speeds.

Tables 3 and 4 give the minimum diameter of pulleys to be used with the standard grades of belting marketed by reliable manufacturers. The tables take the belt speed into account.

The rim velocity of either pulley determines the belt speed in ft. per min. The formula for determining the belt speed is as follows:

Pulley diam. times 3.14 times the r.p.m. of the pulley.

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If the diameter of the pulley is given in in., the answer must be divided by 12 to get the speed in ft. per min.

Example: 16 in. diam. running 250 r.p.m. What is the belt speed?

Answer:

$$\frac{16 \times 3.14 \times 250}{12} = 1046 \text{ ft. per. min.}$$

We will now consider a number of rules pertaining to belting.

Rule 1

To find the right width of belt to transmit a given hp., belt being single leather or 4-ply rubber, multiply hp. to be transmitted by 33,000, divided by the product of ft. per min. times 60.

Example: Belt to transmit 100 hp. at 3,500 ft. per min. = ?

$$\frac{100 \times 33{,}000}{3{,}500 \times 60} = 15\tfrac{1}{4} \text{ in.}$$

For light double leather and 5-ply rubber multiply by 80 instead of 60.

Heavy double leather mulitiply by 100
6-ply rubber .....multiply by 120
3-ply leather .....multiply by 140
8-ply rubber .....multiply by 140

Rule 2

What hp. will a given belt transmit at a given speed, belt being single leather or 4-ply rubber? Multiply width of belt by 60 times ft. per min. divided by 33,000 = hp.

Example: What is the hp. of 10-in. belt at 4,000 ft. per min.?

$$\frac{10 \times 60 \times 4{,}000}{33{,}000} = 72\tfrac{2}{3} \text{ hp.}$$

Table 3

*Minimum Diameter of Pulleys for Leather Belts.

			Linear Velocity —Ft. per Min.		
Width	Ply	Weight	1000	2000	3000 and up
To 8	Single...	Lt.....	2*	2½*	3*
		Med....	3	3½	4
		Hv.....	4	5	6
To 12	Double..	Lt.....	4	5	6
		Med....	8	10	12
		Hv.....	10	13	14
To 24	Triple....	Hv.....	24	30	36

*In inches.

Table 4

Minimum Diameter of Pulleys. Rubber Belts.

Operating Conditions.		Weight of Belt (Plies) Recommended.			
Pulley Diam. (Inches)	Speed R.P.M.	Special Not over	Light Not over	Heavy Not over	Xtra-Hv. Not over
4.....	Over 2,000	4	3	–	–
	Under 2,000...	5	4	–	–
5 to 6.....	Over 2,000	5	3	–	–
	1,000 to 2,000..	5	4	–	–
	Under 1,000...	6	5	4	–
7 to 8.....	Over 2,000	5	4	–	–
	1,000 to 2,000..	6	4	4	–
	Under 1,000...	7	5	4	–
9 to 11....	1,500-2,000....	7	5	4	–
	1,000-1,500....	7	5	5	–
	600-1,000	8	6	5	4
	Under 600	–	6	6	4
12 to 15..	1,200-1,800 ..	–	5	4	4
	600-1,200	–	6	5	5
	Under 600	–	6	6	6
16 to 20..	900-1,200	–	7	6	5
	600-900.....	–	7	6	6
	Under 600.....	–	8	7	6
21 to 30....	Any speed	–	–	7	6
Over 30....	Any speed	–	–	8	7
Over 36....	Any speed	–	–	–	8

These figures are good standard practice.

For other weights of leather or plies of rubber use factors given in Rule 1, instead of 60.

Rule 3

To find length of belt when both pulleys are nearly same diameter, multiply one-half the sum of both diameters by 3.14 plus twice the distance between shaft centers.

$$\left(\frac{D+d}{2}\right) \times 3.14 + 2 \text{ C. D.} = \text{Length of belt.}$$

Example: Open drive 24-in. pulley to 18-in. pulley. 15 ft. between shaft centers.

$$\left(\frac{24+18}{2}\right) \times 3.14 = 66$$

$$15 \times 12 \times 2 = 360$$

$$\text{Length of belt} = \frac{66 + 360}{12}$$

= 35 ft., 6 in.

To find length of belt when pulleys are quite different in diameter, add the following three factors:

A = Multiply ½ sum of diameters by 3.14.

B = Multiply distance between centers by two.

C = Square difference in diameters of pulleys and divide by 4 times distance between centers.

Example: Open drive 72-in. pulley to 24-in. pulley. 20 ft. distance between shaft centers.

$$A = \frac{72 + 24}{2} \times 3.14 = 151$$

$$B = 20 \times 12 \times 2 = 480$$

$$C = \left(\frac{72 - 24}{4 \times 240}\right)^2 = \frac{2304}{960} = 2\tfrac{1}{2}$$

$$\text{Length of belt} = \frac{151 + 480 + 2\tfrac{1}{2}}{12}$$

= 52 ft., 9½ in.

Length of belt for crossed belt drive. Add the factors A and B.

A.—Multiply ½ the sum of the pulley diameters by 3.14.

B.—Square ½ the sum of the pulley diameters and add the square of the distance between shaft centers. Extract the square root and multiply by 2.

Example: Crossed belt drive 14-in. pulley to 16-in. pulley. 12 ft., distance between shaft centers.

$$A = \frac{14 + 16}{2} \times 3.14 = 47.1$$

$$B = 2\sqrt{\frac{(14+16)^2}{2} \times (12 \times 12)^2} = 289.4$$

$$\text{Length of belt} = \frac{47.1 + 289.4}{12}$$

= 28 ft., ½ in.

The above rules are applicable to **horizontal drives** without the use of correction factors. In vertical drives another factor must be taken into account in order to design drives that will prove satisfactory. This factor is the tendency of the belt to stretch under load and fall away from the lower pulley. This will affect the arc of contact in proportion to the size of the lower pulley and may amount to a reduction of one-half of the belt capacity. If this factor is lost sight of in vertical drive it will be the cause of a very unsatisfactory drive.

A liberal allowance always should be made in belt size to counteract the effect of this factor. When worked vertically, wide thin belts will prove the most satisfactory. A good rule given by one of the leading belt manufacturers is to allow one per cent deduction in belt rating for each degree of angle over 40 deg. This is shown more clearly in Table 5.

Table 5

Deductions to make for angle of drive

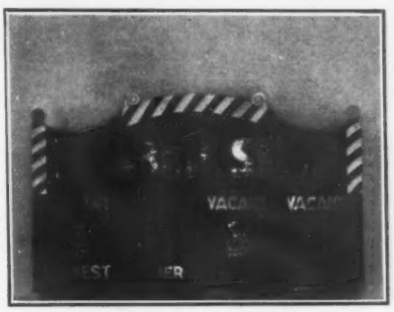
Angle drive makes with horizontal deg.	Deduct from belt ratings per cent
40	0
50	10
60	20
70	30
80	40
90	50

Sign Designed for Barber Shop to Indicate Vacant Chairs

The Exchange Barber Shop, located in the Builders Exchange building in Oakland, Calif., has an unuual sign installed in the members' room of the exchange that indicates what chairs in the shop are vacant at any particular time.

This prevents any humiliation or embarrassment which might arise when a customer has a favorite barber and one of the other chairs is vacant. It is not necessary for the members to look inside of the shop, as the sign indicates when the barber they prefer is not busy.

A switch near each chair controls the lamps in the sign for each barber. There are four lamps in the top part of the sign for general illumination of the barber shop sign. The sign was manufactured by the Imp Sign Company, Oakland, and was installed by the Spencer Electric Company of that city.



This sign above the door in the members' room in the Builders Exchange, Oakland, Calif., indicates what chairs in the adjoining barber shop are vacant at any particular time.

Furniture Building Has Large Electrical Installation

The building constructed for Barker Brothers Furniture Company in Los Angeles contains an unusually fine electrical installation. Each ceiling outlet has a capacity of 1,000 watts and is on a separate circuit. Each of the base plugs throughout the building also is on a separate circuit.

There are 216 circuits for window lighting and a total of 444 circuits is installed on the first floor. A total of 2,500 lighting circuits has been provided for and 2,445 of these are connected at present; the connected lighting load amounts to 9,300 amp. A total of 750 hp. is connected.

The accompanying pictures present some of the outstanding features of interest from the viewpoint of the electrical engineer or contractor. Fig. 1 shows a number of conduit runs suspended from the ceiling. There are 42 conduits ranging in size from 1¼ in. to 3 in. suspended in this manner. No conduit smaller than ¾ in. was used in the job. Fig. 2 shows the rear view of the main switchboard. It may be noted that no wires are exposed; all wires were brought to the pullbox above and below and then sweated into lugs. This board was manufactured by Brown & Pengilly of Los Angeles. Fig. 3 is a front view of the board, which is 23 ft. long and 10 ft. high. There are three rows of switches on the board as may be seen. The manner in which the conduit runs branch at the ceiling is particularly noteworthy.

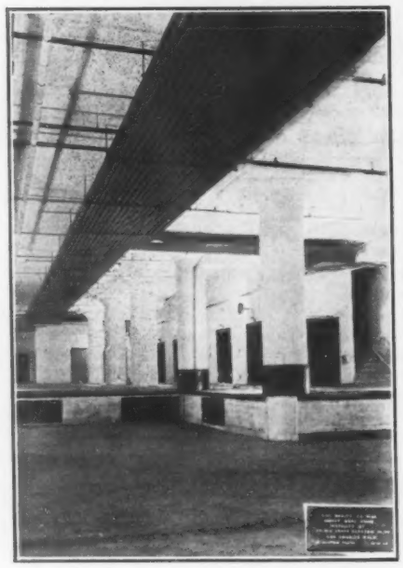


Fig. 1.—A practical method of suspending conduit runs from the ceiling.

Fig. 2.—Rear view of the main switchboard. Note that there are no exposed wires.

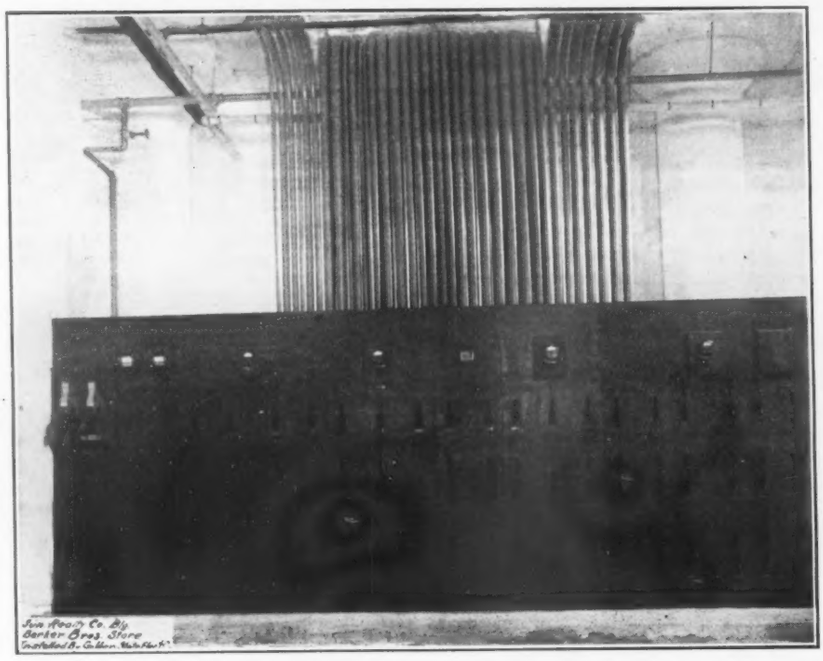


Fig. 3.—Front view of the main switchboard showing the three rows of switches. Notice the manner in which the conduit runs branch at the ceiling.

Other material used included: 136,000 ft. or 25½ miles of conduit; 550,000 ft. or 102 miles of wire; 470 lb. of solder; and 500 lb. of tape.

The electrical installation was made by the Golden State Electric Company of Los Angeles. Labor equivalent to the efforts of one man working continuously for 16 years was required in completing this work.

Questions and Answers on the Code and Safety Orders

Arrangements have been made with Claude W. Mitchell, electrical engineer of the Board of Fire Underwriters of the Pacific, to answer through the columns of the Journal of Electricity such questions on the National Electrical Code as are of general interest.

Similar arrangements have been made with George E. Kimball, electrical engineer of the Industrial Accident Commission of the State of California, to answer questions on the Electrical Safety Orders issued by the Commission.

While it is the object of this department to assist in a better understanding of the Code and the Safety Orders, replies given are not to be considered as official interpretations applying in all instances, as some of the rules permit of varying interpretations under different conditions. The questioner should be guided by the inspection department having jurisdiction.

All who are interested are invited to send in their inquiries regarding the National Electrical Code to Claude W. Mitchell, Board of Fire Underwriters of the Pacific, Merchants Exchange Building, San Francisco, Calif., or to the Editor, Journal of Electricity, 883 Mission Street, San Francisco. Questions on the Safety Orders should be sent to George E. Kimball, Industrial Accident Commission, State Building, Civic Center, San Francisco, or to the Editor.

Q. 5. May the frames of portable heaters be grounded by connecting the frame to the grounded neutral?

A. No. A 3-wire cord is required with three-conductor plugs and receptacles. See Order 702-1(x). The conductor attached to the frame for grounding must be connected through the plugging receptacle to a grounding conductor. In a conduit system this grounding conductor at the receptacle may be attached, in an approved manner, to the grounded conduit but not to the grounded neutral.

Q. 6. May more than nine wires be installed in one conduit?

A. Usually nine wires are the limit, except in cases where there are short straight runs or special installations where special permission is granted by the inspection department having jurisdiction. See Orders 703-3(c) and the second paragraph of Order 703-3 (a). Exceptions also are made for certain wiring in theaters, on signs and in other locations.

Electrical Men Assist in Proper Kitchen Layout.—Electrical men in Seattle, Wash., co-operated with the Seattle Post-Intelligencer's women's department in a "Dream Kitchen" contest, in which prizes totaling $85 were given for the best plan for a modern kitchen. J. J. Agutter, electrical engineer, gave his idea of the proper arrangement of lights and the number of convenience outlets required to make a kitchen 100 per cent in convenience and efficiency.

Floodlighting Installation Sold to Denver High School

What is described as being the best addition to the civic beauty of Denver, Colo., in recent years is the effect produced by the floodlighting of the new East Denver High School. This is the first attempt to floodlight a public structure in Denver, and the favorable comment heard from every group throughout the city augurs well for similar activity in connection with the construction of a new five-million-dollar municipal building.

Denver High School floodlighted by means of a temporary installation used in selling a permanent job to the school board.

To the staff of the Electrical League of Colorado credit is due for the development of the floodlighting idea in Denver. In the case of the new high school it was the league staff which suggested the experimental arrangements and supervised the temporary installation illustrated in the accompanying photograph.

Although the school board has not given its final and official approval to the permanent floodlighting scheme, the weight of public sentiment is so strong that it is considered only a matter of formality. The location of the building not only permits but demands, it is said, an outside lighting scheme. It is located on the esplanade leading to the city's principal park and is at the head of one of the main residential thoroughfares. In the summer it is one of the show places for tourists, especially on the twilight tours of the city. The architecture lends itself to a decorative lighting scheme, and the presence of a large clock in the tower makes night lighting highly desirable.

This new high school has been occupied only five months, and during the period of construction no outside lighting arrangements were permitted consideration. With no facilities having been provided in the design of the building, the floodlighting scheme is one which has proved mainly dependent on finding means and methods of installing the 500-watt floodlighting units used.

Advanced Apprentice School Starts in San Francisco

An advanced school for apprentices has been opened by the Industrial Association of San Francisco, with 20 boys enrolled for instruction. The class meets one night each week at 1120 Howard Street, and the instruction does not cost the boys anything as all the expense is borne by the Industrial Association.

The class is conducted along the lines of the beginners' apprenticeship school, details of which were given on page 60 of the Jan. 15 issue of the Journal of Electricity. It is probable that another beginners' class will be started in the near future as a number of applications have been received from boys who cannot be accommodated in the present class.

Municipal and Civic Headquarters Entirely Electrical

The City Hall building in Lemoore, Calif., which houses the municipal offices, the fire department and the Chamber of Commerce, and contains public rest rooms as well, is heated throughout with electric air heaters. Majestic air heaters having a total capacity of thirty-seven kw. are installed.

The city council chamber can be converted into a banquet hall capable of seating 200 people. Adjoining this is an electric kitchen equipped with a seven-kw. Hotpoint automatic range and a seven and one-half kw. electric water heater.

The fire department headquarters include a large club room and bath and shower room, in addition to the engine house and dormitory. Automatic switches turn on the lights in the engine house and dormitory when an alarm comes in.

George M. Rankin of the California Electrical Bureau was primarily responsible for selling the idea of installing electric air heating in the building. The electrical installation was made by the Lowe Electric Shop, electragists of Lemoore.

Irrigation District Will Not Inspect Private Wiring

The Modesto Irrigation District will not inspect private wiring, according to a decision reached at a recent meeting of the board of directors. This decision was reached after employees of the district had stated that improper wiring had been responsible for several fires in rural homes. It was said that the wiring in many instances was installed by the owners or others who were not qualified to put in a safe installation. The fear was expressed that the district would be liable in case one of its employees was appointed as an electrical inspector.

There was some talk of urging the county supervisors to adopt an ordinance establishing an inspection service and a standard of wiring.

The failure of the board to appoint an inspector probably will result in the appointment of an inspector by insurance companies. The insurance companies will inspect all present wiring where insurance is carried and will instruct owners to have such repairs or rewiring done as is deemed necessary. If the rewiring is not done within the time specified, insurance will be cancelled. Those who do not carry fire insurance will not receive the benefit of the inspection service.

One From Eidlitz.—Charles M. Eidlitz, chairman of the New York Electrical Board of Trade, has had a motto for thirty years, "Folks who never do any more than they get paid for never get paid for any more than they do."

The Amann Electric Works have moved from their old location at Pico and San Pedro streets, Los Angeles, to a new store at 3703 S. Park Avenue. Since the firm specializes in motor repair sales and installations, its new location will be more advantageous as it is in an industrial district.

Fire-department club room in the City Hall Building, Lemoore, Calif.

BETTER MERCHANDISING

Always Open Season for Electric Ranges

A Study of Methods Used in Sales of Gas Ranges Is Helpful in Electric-Range Sales

While it may be true enough that "there's nothing new under the sun," it is also true that to an enterprising salesman that fact does not necessarily cramp his style. If there is nothing new under the sun, there are plenty of people who haven't seen everything to whom even an old idea, especially if it is dressed up in modern short skirts is attractive.

It is likewise true that he who would succeed in one line of business may often glean ripened fruits of experience from the more mature trees of some other orchard of activity. Thus the dealer in hardware gets ideas from a millinery window or a grocery store that he can translate into hinges and brass door knobs. The man who sells phonographs gets his method of selling high-priced pieces of musical furniture from the chap who sells you a car that you can't afford. Isn't it possible that those who would sell electric ranges, then, might well examine some of the experiences and sales policies of those who have pioneered a like field in the sale of gas ranges?

Gas-range sales have been reduced to something of a science. The dozen or more manufacturers of such appliances are applying modern principles of sales effort to their wares and getting results. They have been able to get not only gas-appliance dealers to sell ranges, they have everybody selling them, from the corner hardware store to the "you-furnish-the-girl-we-furnish-the-house" furniture dealer.

With the advantages in cleanliness, control features, appearance, absence of surplus heat, and superior cooking qualities, it would only be rank inefficiency which could not succeed in placing electric ranges on a market that is anxious for those features of service.

Eliminate the Wiring Bugaboo

Wiring costs and arrangements have been a bugaboo in the past, but there is no reason in the world why the customer should know that such a problem exists. It is well to settle upon some definite policy in respect to wiring installation for range sales, and then, if possible, include it in the price of the range, entirely removing it from possible concern on the part of the customer. The customer feels that it's the merchant's problem anyway and doesn't want to be worried with it.

A movement which promises well in this direction is the plan being worked out by the California Electragists, Southern Division. Seeking the advice and counsel of the power companies in the district as well as the electrical inspectors this group is working out a set of standard wiring hookups, at standard prices, to be sold with the range and financed in a unique way to cut down costs and provide a standard job at a low price. More detailed announcements of the plan will be made later in these columns.

A range sold "installed" is a range sold without the necessity of overcoming a needless resistance resulting from a customer's ignorance of wiring procedure and his consequent fear of it. It is an accepted fact that any house in a metropolitan area served by gas is equipped to serve a gas range without any appreciable bother. Why shouldn't this same feeling be brought about with respect to electric ranges?

Know Your Selling Costs

One of the scientific selling principles employed in gas-range sales is an intelligent study of selling costs. What does it cost to sell a range; that is, what are the actual selling costs themselves, apart from the manufacturer's price for the merchandise, plus freight, etc.?

One large furniture dealer estimates his selling costs on gas ranges on the following basis. It suggests what points might be studied to arrive at an intelligent understanding of what it costs to sell electric ranges.

Following are the items chargeable to the selling of a gas range:

Administration	$5.50 per range
Shop	4.00 per range
Floor rent	1.65 per range
Advertising	4.71 per range
Buying	1.63 per range
Selling	6.92 per range
Total selling cost	$24.41 per range

With electric ranges at present, this selling cost probably would run higher in some localities where the pioneering has yet to be done. Whatever the selling costs are, they should, however, be appreciated fully and taken care of in the plan of sales.

Administration in this case included office overhead, bookkeeping, personnel, and such other items as enter into the administration of a store. The share of that cost per gas range in that instance was $5.50. The shop item is that which charges to each range its share of the cost of servicing and repairs. The proportion of the store rent chargeable to a range is next taken into consideration and depends largely upon how long the range stays on the floor. The advertising cost is obvious and will be seen to be but a modest proportion of the total selling cost. Buying costs are those costs incurred in the selection of merchandise, and the selling cost listed above is the actual sales cost on the floor in salesmen's time.

Electric Cookery is Better Cookery
Electric Range Clean
My Electric Cooking Bills Never Bother Me
Our Special Offer
$9.75 Down
Balance Over 18 Months
Free Oven Outfit
BRITISH COLUMBIA ELECTRIC RAILWAY COMPANY LIMITED

Well prepared broadside used by the B. C. Electric Railway Company in creating prospects for electric ranges. The emphasis of the sales appeal is made upon the better cooking results possible with electricity and allaying the idea that electric cooking is expensive. The argument is clinched with a low down-payment offer, attractively priced.

Cheap Price Not Necessary

Records of great merchandsing establishments selling gas ranges also reveal that the lowest-priced range isn't the biggest seller by any means. Naturally, in electric range sales there has been a consistent effort to bring electric ranges down to such a price level as to make them available to the average home. That price level has been achieved, and electric-range prices compare favorably with gas-range or other stove prices.

It is estimated that the average of all prices for gas ranges is $74.49, but that the average of ranges sold sell for $96. This is a significant fact to the merchandiser of electric ranges and should go far to dispel the idea that people do not buy expensive ranges.

Why Women Buy Electric Ranges

What qualities does a woman demand of a range? What motives may be created which will result in the sale of an electric range to the housekeeper of the modern home? These are considerations it would be well to look into, for it is upon these factors that sales most easily may be fostered.

E. A. Norton, of Barker Brothers, Los Angeles, at a recent electric range committee meeting set forth the following cardinal sales principles. These are the reasons women buy gas ranges. They are also better reasons why women will buy electric ranges.

1. TRADE-IN of an old range is a big item in making sales. Whether the amount allowed for the old cook stove is large or small, the fact that the purchaser gets something for it, that it doesn't have to be junked or that tiresome bickering with secondhand dealers will not be required, is enough to push over many a sale where every other factor is assured.

2. EASY TERMS in this day and age have universal appeal. It is much easier to buy an article that is sold at $5 down. All the customer looks at is the down payment, and his impression of the magnitude of the total price of the range is lost if the start can be made easy.

3. PROPER PRICING is important. Not that it is necessary to make the price low, for expensive ranges are being sold as often as cheaper ones, but the price should be made to seem attractive.

4. "HOW WILL IT LOOK." Women today are interested in the interior decoration of their homes. They are being educated by magazines, by example, and by general tendencies to make the home an attractive place. And the kitchen is being made the most attractive spot in the modern home. So women demand a range that looks well, that they may be proud to possess. There are two things a woman asks of a range. The first is, "How will it look?" and the second is—

5. "HOW WILL IT COOK?" Electric cooking has so many advantages in its favor that many a sale is made on this point alone. The preservation of the natural juices of meats and vegetables cooked in an electric oven, the perfect regulation possible, and other features of electric cookery are invincible arguments.

6. CONVENIENCE is a big item. The automatic features of an electric range promise freedom for the housewife from the slavery of a kitchen. The cleanliness of the electric range, the fact that it takes so little fussing around to operate successfully, the perfect regulation afforded by it, all spell a consideration for the woman's domestic problems that she appreciates and desires.

7. IDENTIFY the piece of merchandise you sell with the good name of your company. That gives the purchaser confidence in it from the start. She doesn't feel that it is an untried thing. Make her feel that if anything should go wrong, or if she should have any difficulty in learning to use it, you would straighten it all out. There's comfort in that thought. Foster it.

Oakland, Cal., Has Largest Cooking School in State

Prizes Given for Cakes, Pies; Nursery for Children and Foodstuff Dealers' Co-operation Feature Event

The free electric cooking school held in Oakland, Calif., by the Oakland Tribune is said to have been the largest one conducted in the state up to that time. The course was given in the Oakland Municipal Auditorium Theater from two to four in the afternoons of four successive days, from Tuesday to Friday, Jan. 19-22, 1926.

The sessions of the school included complete demonstrations of the preparation, cooking and serving of staple foods, desserts, meats, fish, poultry, and complete meals. Clear and accurate explanations of the processes were given by Miss B. E. Galvin and Miss L. Carol Dangler, home economists for the Edison Electric Appliance Company.

The last day of the school was featured by a baking contest divided into cake and pie divisions. The 1,000 entries received were baked in the homes of the contestants on any kind of range. The ingredients used had to be those advertised in connection with the school. After the contest the entries were turned over to the Salvation Army Rescue and Maternity Home to sell and the $400 received therefrom was devoted to the needs of the Home.

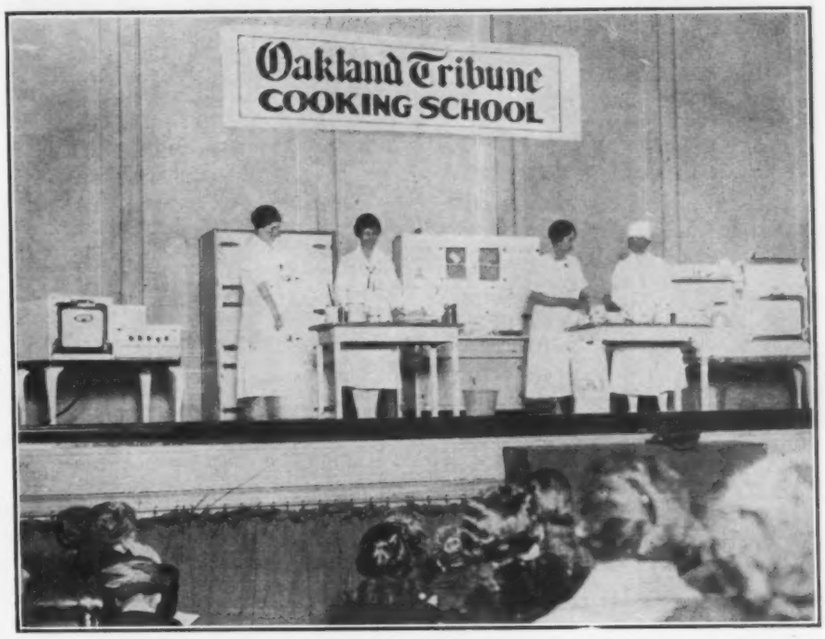
Prizes aggregating $1,000 were given away in this contest, there being twelve prizes in each of the two divisions. The first prize in the cake division was a super-automatic Hotpoint electric range and the second prize was a Thor folding electric ironer. The first prize in the pie division was a Maytag electric washer; and the second prize a Check Seal electric vacuum cleaner. In addition to the prospect of winning a prize, every entrant in the contest received a one-pound can of Crisco.

During the time the school was held all of the prizes were displayed in the lobby of the theater. In addition to the prizes, a number of electrical appliances were on display in show cases.

Three question boxes were located at convenient places in the auditorium so that those in attendance might submit their cooking problems to the home economists for solution. These questions were answered from the stage each day.

One of the unusual features of the school was a nursery with a competent nurse in charge to provide for the little children who could not be left at home. By this means a great many mothers who might otherwise have had to stay at home were able to attend the school.

During the week two radio talks were given over KLX. On the Monday night previous to the opening of the



The stage of the auditorium was used as a demonstration kitchen for the largest electric cooking school held in California, conducted in Oakland recently.

school Miss Galvin gave a talk on the progress of cooking. Miss Dangler talked Wednesday night on the modern home in which she told how a woman equips her workshop and the particular work preformed by each electrical appliance in the home.

Prior to the school the Pacific Gas and Electric Company and the Great Western Power Company sent invitations to their residence consumers in Oakland to attend the school. The Pacific States Electric Company sent an announcement relative to the school to its dealers and urged them to take advantage of the opportunity to the fullest extent. The Globe Mills sent announcements to a number of grocery stores urging them to tie in with the school. Announcements concerning it were made in the city schools, the Parent-Teachers Association and the Nurses' Association.

During the week following the Tribune Cooking School, schools were conducted in the Pacific Gas and Electric Company auditorium and at Breuner's in Oakland. The Thomas Day Company had a demonstrator in its window. Window displays were made in the windows of the Great Western Power Company, Capwell's, Sperry Electric Homes, Breuner's and the Pacific Gas and Electric Company.

Let Them Guess Cost of Complete Electrically Cooked Meal

A notion still prevails in some quarters, along with others of the same character and up-to-dateness, that just because a meal is cooked on an electric range it must cost a young fortune. And while to the electrical industry that idea has been relegated to the realms of myths the notion still keeps many otherwise good prospects from being at all interested in electric cooking.

To dispel this archaic idea, one live merchandiser, J. C. Hobrecht of Sacramento, Calif., decided upon a plan which should be useful to many other range dealers. He decided that to "debunk" the "high-cost-of-electric-cooking" idea he would institute a contest in which the one who guessed nearest the cost of cooking a complete meal would receive a prize.

The guesses made proved exactly what was expected. They ran all the way from 3 cents to 35 cents, all of them wrong. On the specified day for the close of the contest the complete meal was cooked. and the wattage figured up. And the actual cost of the meal in electrical energy was found to be less than 2 cents, .0192 to be exact.

A revelation to those who took part in the contest, this method of bringing the matter forcibly to their attention succeeded in making prospects of a large percentage of them and customers of many of the prospects.

Makes Store a Range Headquarters

Mr. Hobrecht also has discovered another interesting phase of range-sales psychology. Sometime ago he decided that he would carry also a complete line of gas ranges since the territory in which his store is located is served economically with that fuel.

"I find," said Mr. Hobrecht, "that the presence of a complete line of gas ranges helps me immensely in my electric-range sales. You might not htink so at first glance, but the fact that we have all kinds of ranges has established our store as a complete stove store, a range headquarters.

"So when people here think of ranges they think of this store. As a result many a customer who has come in to look at gas ranges has seen the electric ranges on the same floor, and with the advantages of the electric range pointed out to her has bought the electric range rather than the gas range. Every range-buyer is told of the advantages of the electric range, and I believe we get more range prospects by this method because we get both the gas and the electric-range prospects."

Check your children here. Where the mothers parked their children during their attendance at the school sessions. A veritable day nursery was conducted to keep the children happy while mother learned to bake and cook the electrical way.

San Joaquin Offers Employees Sales Courses at Cost

Courses in lighting sales, merchandise sales, and power sales are being offered the employees of the San Joaquin Light & Power Corporation, Fresno, Calif., according to a recent announcement in the company magazine. The courses offered are proffered to employees upon an easy-payment basis and at reduced cost.

The courses chosen by the educational committee are those prepared by the National Electric Light Association. The company is to assume the cost of the courses, reimbursing itself for them by deductions from the monthly payroll of those employees taking advantage of them. The company pays one-half of the cost of the course itself, however, giving the employee the course at half cost.

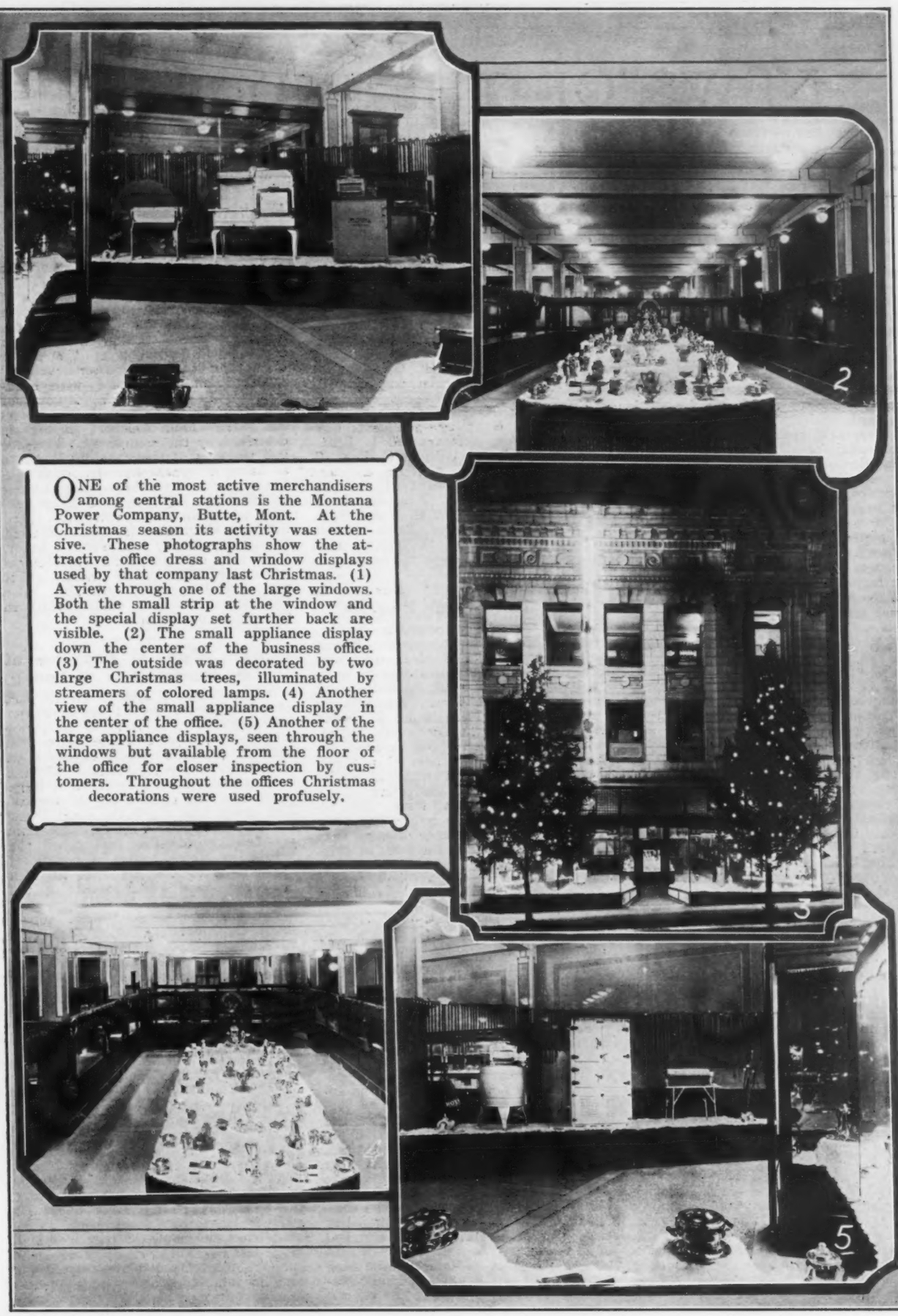
In addition to this, the course of instruction given by the company to its employees last spring is to be repeated for the benefit of those who did not take advantage of the previous opportunity. This course is to be given free. It covers the history, organization and operation of the company system as well as elementary instruction in electricity, the financial structure of the company and outlines of departmental work.

Six N. E. L. A. courses also are offered for those interested in accounting, engineering and operating branches of the industry. The commercial courses are those on lighting sales, merchandising sales, and power sales. Classes are to be maintained, with class leaders arranged for

Department Store Holds Electric Appliance Exposition

Several hundred feet of floor space recently were devoted by the electrical department of Holzwasser's Department Store, San Diego, to what was termed "San Diego's first electrical exposition. Timed to include the busy Christmas shopping season, the exposition was visited by many thousand people, the majority of whom were interested housewives, the best potential customers.

Quarter-page advertisements were run daily for a week or so preceding the exposition, anouncing various features. One advertisement read, "Everything possible has been done to make this exposition of immense educational value to the women who seek to modernize their homes. The newest designs in household labor-saving devices of the foremost standard manufacturers will be on exhibition. You will see the very newest types of washing machines, including Thor cylindrical type, the Easy vacuum cup, the Sunbeam oscillator and the new Gain-a-Day. Then you will see the Eureka, Premier Duplex, Cadillac, Liberty and Perfection vacuum cleaners, in addition to hundreds of other smaller electrical household appliances." One of the biggest drawing cards was the announcement that free waffles and coffee were to be served all day long throughout the exposition.



ONE of the most active merchandisers among central stations is the Montana Power Company, Butte, Mont. At the Christmas season its activity was extensive. These photographs show the attractive office dress and window displays used by that company last Christmas. (1) A view through one of the large windows. Both the small strip at the window and the special display set further back are visible. (2) The small appliance display down the center of the business office. (3) The outside was decorated by two large Christmas trees, illuminated by streamers of colored lamps. (4) Another view of the small appliance display in the center of the office. (5) Another of the large appliance displays, seen through the windows but available from the floor of the office for closer inspection by customers. Throughout the offices Christmas decorations were used profusely.

NEWS OF THE INDUSTRY

High-Tension Underground Lines a Coming Necessity

Continued expansion of metropolitan load centers and the continued growth in power demand even in many sections which otherwise show no particular signs of growth are causing problems increasingly difficult of solution to electric utilities. From year to year it is becoming harder to get power in sufficient quantities to strategic distribution points.

Attempts have been made and are being made to satisfy this condition through underground transmission of power at comparatively low voltages. However, G. M. Gest, underground electrical constructor of national repute, states that the ultimate solution lies only in the more general adoption of underground construction for voltages as high as 80 kv. to ground. According to Mr. Gest, present developments in cable design and manufacture fully warrant this step wherein high-tension power may be brought easily into the hearts of metropolitan load centers.

Two Japanese Power Companies Plan Power Developments

Two Japanese power companies are planning additions to their systems, according to Denkinotomo. The Tokyo Electric Light Company has been granted permission to construct a steam plant at Tsurumi near Tokyo. Four turbo-generators of 35,000-kw. capacity each are to be installed. The company already has purchased a 25-acre site for the plant, which is expected to be completed before the close of 1927.

The Daido Electric Power Company has under way plans for a power development project at Nishikizu where by the construction of a dam 100,000 kw. of electrical energy will be available.

Consolidation of Power Companies Effective as of Feb. 1

The arrangement for the consolidation of The California Oregon Power Company with the California Power Corporation, the latter company being controlled by H. M. Byllesby & Company, has become effective, and the exchange of the stock owned by the stockholders of The California Oregon Power Company for the securities of the new company has been made as of Feb. 1.

There has been no change in the corporate structure of The California Oregon Power Company and no change in its operating personnel. Paul B. McKee, vice-president and general manager of The California Oregon Power Company, together with the other members of the organization, who have been associated with him in the past successful operation of The California Oregon Power Company, will continue in the same capacity. J. D. Grant and John D. McKee have resigned as chairman of the board and president, respectively, but will continue as members of the board of directors. J. J. O'Brien, president of H. M. Byllesby & Company, has been elected president of The California Oregon Power Company.

Other officers are: P. O. Crawford, vice-president and chief engineer; W. M. Shepard, vice-president and general agent; H. H. Jones, vice-president; R. G. Hunt, vice-president; Darwin G. Tyree, secretary; H. L. Bromley, W. G. Drew, William G. Pohl, C. H. O'Reilly, and P. A. Seitz, assistant secretaries. The board of directors consists of: Halford Erickson, R. J. Graf, J. D. Grant, R. G. Hunt, H. L. Jackman, H. H. Jones, Samuel Kahn, J. J. O'Brien, John D. McKee, Paul B. McKee, and George N. Rooker.

Los Angeles Light Bureau to Continue 3-Year Program

Gross revenues amounting to $10,600,000 were returned by the Bureau of Power and Light of Los Angeles, Calif., during 1925, according to a report made public by E. F. Scattergood, chief electrical engineer. Expenditures amounting to more than $7,700,000 were made on extensions and betterments. Mr. Scattergood pointed out that this was all a part of a three-year construction program laid out in 1924 at the time of the voting of the $16,000,000 power-bond issue. The report shows that new power and light consumers to the number of more than 15,000 were added to the lines in 1925.

It is estimated that $5,000,000 will be expended on the three-year program during 1926. Much of this sum will be used in providing additional substations. Nine substations were built during 1925 by the bureau. In addition to this building program, a stand-by steam plant and transmission line from it are to be built near Seal Beach, it was announced recently.

San Francisco Office of Geological Survey in New Quarters.—Effective Jan. 1, the San Francisco office of the Water Resources Branch, U. S. Geological Survey, Department of the Interior, has been moved to Rooms 302-305 U. S. Custom House, and combined with the distribution office. A supply of all geological survey publications, available for free distribution, is kept in stock and may be obtained at the office or requested by mail. Unpublished stream-flow records of the Geological Survey are available for use at this office, or blueprints will be mailed upon request. The library, which contains much valuable data, is maintained for the use of the public. H. D. McGlashan is district engineer.

Wetherill Medal Awarded for Fynn-Weichsel Motor

The Wagner Electric Company of St. Louis has been awarded the John Price Wetherill Medal by the Franklin Institute, "with special mention of Val. A. Fynn and Hans Weichsel, in consideration of the progress in the electric art which this invention marks and of the development of a motor of excellent design and construction."

The Franklin Institute, with headquarters in Philadelphia, is one of the oldest scientific societies in America. The Fynn-Weichsel motor is described by the committee on science and the arts of the Franklin Institute as being a "synchronous-induction motor, either two or three-phase, having an automatic self-generated direct current to obtain the synchronous speed but with characteristics quite different from the ordinary synchronous motor. It may be used to produce mechanical power at unity power factor, or it may produce power and also raise the power factor of other motors in the same installation."

Damage Slight in Explosion at Los Angeles Main Station

An unsuccessful attempt on the part of a laborer for the Bureau of Power and Light of Los Angeles to throw a guy wire over a transmission line Jan. 18 caused a violent explosion at the main receiving station of the bureau and temporarily threw a large portion of the system out of service. The heavy load which the short threw on the substations from which the line was feeding caused an explosion in the substation which hurled a couple of skylights into the air that in turn destroyed some aerial work on the roof.

According to C. A. Heinze, superintendent of distribution for the bureau, the explosion was caused by the ignition of oil vapor which had formed due to the heavy duty on the oil switches during the trouble. No one was injured and the property damage was very slight.

Application Filed for Power Development in Trinity County, Calif.—J. B. Knight, Fred M. Kay, J. L. Stone, W. H. Haw, Frank Breeden, and David Wilson, have applied to the Federal Power Commission for a preliminary permit for a power development in New River, in Trinity County, Calif. A 50-ft. dam, having a crest 250 ft. in length, would divert water from the river through a conduit about 12 miles in length to a power house to be built near the mouth of the river and to have an installed capacity of 5,000 hp. The developed power would be used in lumbering and mining operations.

Colorado Problems Discussed at Warm Meeting of Commonwealth Club

The several and variant aspects of the Colorado River situation, presented by leaders in the respective phases of that situation and augmented by discussion by well known engineers following the papers, lent to the Feb. 18 meeting of the Commonwealth Club of California, San Francisco, something of an echo of the controversy going on in Washington over the same situation.

The principal speakers were: Burdette Moody, business agent, City of Los Angeles Bureau of Power and Light and secretary of the Boulder Dam Association; J. C. Allison, Calexico, Calif., for seven years chief engineer of the California Development Company, and active in Imperial Valley development in Mexico and United States since 1903; M. J. Dowd, superintendent of the Imperial Valley Irrigation District, and George L. Hoxie, consulting engineer, Los Angeles, representing R. H. Ballard, vice-president and general manager, Southern California Edison Company.

Following the papers five-minute discussions of the subject were engaged in by Arthur P. Davis, formerly chief of the Reclamation Service and now general manager East Bay Municipal Utility District, Oakland; John D. Galloway, consulting engineer, San Francisco; Chester Rowell, publicist and former member of the California State Railroad Commission, and others.

Burdette Moody urged support of the Swing-Johnson Bill in its modified form as recommended by Hubert Work, Secretary of the Interior and outlined Los Angeles' need for water and power. He stated that by the time Boulder Dam can be built Los Angeles can use its entire output of electrical energy and 15,000 sec-ft. of water for domestic purposes.

J. C. Allison presented the rights of American land-owners of Mexican lands in the Imperial Valley and dismissed all other propositions as obstacles to the real need, that for flood control. He outlined the origin of the demand for the All-American canal and charged that it would be prohibitive in cost to build and to maintain, except at government expense.

M. J. Dowd, presenting the Imperial Valley irrigationists' side, also drew a picture of the danger from flood in which the valley stood, and advocated the building of Boulder Dam because, as a combined power and flood-control project, it could be made to pay for itself from power sales. He made an impassioned, extemporaneous talk, making much of the fact that although it has only about a third as much land under irrigation as has the American side of the Imperial Valley, Mexico can and does claim half the water from the present canal. He also showed that present flow of water at dry seasons is not sufficient to serve all demands.

Reading Mr. Ballard's paper, George L. Hoxie described the Edison company's surveys and power-right filings on the Colorado, and stated that had these been allowed to proceed according to the provisions of the Federal Water Power Act power would have been delivered from the Colorado three years ago, flood control would have been provided automatically, and water for irrigation purposes plentiful. "Since then so many politicians have been elected to office on Colorado-River issues that one wonders if they really want to see the question settled. The project has evolved from the realm of economics and engineering to one of political excitement," the paper stated. Going on to show that steam generation of energy was now as cheap as water power, Mr. Ballard's paper outlined the Edison company's balanced program of development and showed that southern California has no need to fear power shortage even if the Colorado River is not developed immediately. "If the question were in the hands of business men," Mr. Ballard's paper stated, "I believe that a business-like solution of it could be made, satisfactory to all of the contesting parties. But the politicians have made a beautiful mess of the whole situation and we ought to insist that the politicians settle it." He added the suggestion that an amendment to the Work proposal for an immediate flood-control dam at Mohave site be made, while Boulder was being built.

Arthur P. Davis, in the discussion period following the papers, championed the Swing-Johnson Bill and Boulder dam, maintaining that the All-American canal was declared impractical under his administration only because storage had not then been contemplated.

John D. Galloway threw a carefully prepared bombshell into the meeting in the way of a paper deploring the Swing-Johnson Bill and government financing and operation of a big project on the Colorado for what he said was the benefit of Los Angeles Bureau of Power and Light. Beginning dramatically, "A curse of politics has fallen upon the Colorado River seven times worse than the curse upon Egypt," Mr. Galloway went on to denounce the Boulder Dam project as a raid on the U. S. Treasury, and to deplore the fact that the United States in this project was abandoning its attitude of impartial arbiter to break faith with its own people in invalidating the Water Power Act. "The All-American canal would never have been heard of if the international boundary had been thirty miles farther south," said Mr. Galloway, preliminary to showing that Mexico enjoyed rights which only international treaties could alter.

Chester Rowell, called upon to speak, merely referred to the latest reservations insisted upon by Secretary Work in respect to the project, and Mr. Davis was given further time to speak of the flood danger in Imperial Valley. Mr. Davis closed the meeting with an urgent plea for quick action "for if Boulder Dam is not built quickly the time is not far distant when it will not be needed," he said, implying that Imperial Valley would be flooded and ruined.

Experimental Arch Dam Being Built on Stevenson Creek

Work has started at the site on Stevenson Creek, Calif., selected for the experimental dam that is being built by Engineering Foundation's committee on arch-dam investigation. By the middle of February excavation for the foundation had been completed and all materials for building this structure were on the ground. The committee meantime had been completing plans for the devices and methods to be used in measurements and tests.

All essential measurements are to be made by at least two independent methods. These will have three objectives, namely, the measurement of (1) deflection of the structure, (2) deformation (as an index to the internal stresses), and (3) temperature.

For deflection measurements five steel towers, 5 ft. square and extending to the full height of the dam, are to be located on the downstream side. These towers will be enclosed in wooden sheathing to protect them from wind and unequal temperature stresses and means will be provided for checking the vertical alignment. The towers will be located at the center and at 20 and 40 ft. on either side.

At 5-ft. vertical intervals Invar distance pieces will extend from each tower to the dam whereby the variations in this distance or, in other words, the deflection can be measured by electrical means at a central point remote from the structure. This electrical device consists of a coil of high-resistance wire mounted upon an insulating core and a sliding contact, the ratio of the electrical resistance bearing a direct relation to the movement in the bar.

To check deflection measurements a specially designed clinometer will be used to measure variations in deflection between reference points that are likewise spaced at 5-ft. vertical intervals. This device consists essentially of a vertical shaft affording a sensitive level bubble (about 4½ sec. of arc) brought to a truly vertical position by a standard Starret micrometer head. A third deflection measurement will be made with the use of theodolites by which intersections will be secured on a number of points at the base and crest of the dam.

Deformation is to be measured by 150 electric telemeters buried in the concrete of the structure. These telemeters developed and calibrated by the United States Bureau of Standards depend on the principle that a stack of thin carbon disks has an electrical resistance, which changes with pressure variation. The amount of this resistance, therefore, measured in a remote central location in the dam will give an index of the strain in the concrete at the telemeter location.

The check method for measuring strains will use a specially designed strain gage whereby the deformation of a large number of octagon figures on the downstream surface of the dam will be observed. In general these octagon figures will be located at 10-ft. intervals horizontally and vertically

and will be supplemented by corresponding measurements on the upstream face of the dam when the water is low enough to make such measurements practicable.

Temperature measurements are to be made with a coil of wire which will provide an electrical index of the temperature at each telemeter location. As a check, direct readings of temperature will be taken on thermometers inserted in holes to be left in the concrete for that purpose.

Special care is being taken to secure uniformity of concrete, both in regard to the various sizes of aggregate used and in uniformity of water-cement ratio as well as in observing absolute uniformity as to the time used in mixing the various batches. In addition to specimens made to be tested at 7 days, 28 days and at some longer period, specimens also will be retained for test at the time of actual failure of the dam. Test specimens for the determination of characteristics other than strength will be sent to testing laboratories at the University of California.

The project is sponsored by the Engineering Foundation of which Alfred D. Flinn is director. The work is in the hands of the Committee of Arch Dam Investigation of which Prof. Charles D. Marx is chairman, and the subcommittee having immediate charge of the construction and tests is headed by Harry Hawgood as chairman. The experiment has been made possible through the generous financial cooperation of a large number of interested companies and by the Los Angeles County Flood Control District. The committee is desirous of receiving constructive criticism of its program, and any such communications should be sent to Mr. H. Hawgood, 722 H. W. Hellman Building, Los Angeles.

"New Mexico Utilities Association" New Name Decided on at Albuquerque Convention

Development of women's committee activities, the entry of utility companies other than electric into the organization, improved public relations policies, interesting technical developments in the electric industry, combined with a sketchy review of oil, cotton and other forms of business in New Mexico were the high lights of the eleventh annual convention of the New Mexico Electrical Association in Albuquerque, Feb. 15-17.

Nor was the Colorado River situation overlooked, as evidenced by the official utterance of Governor A. T. Hannett in an address of welcome at the opening session of the convention. He referred to the fact that as soon as Arizona decided upon acceptable terms some headway could be made.

Politics was an off issue of the convention, in fact every feature of the convention proved too successful to permit of its introduction in any form. All present acclaimed the manner in which the convention was arranged and conducted by Arthur Prager, manager of the Albuquerque Gas and Electric Company, and former president of the association, who is also first vice-president of the Rocky Mountain division, N.E.L.A.

Of especial interest was the presentation of technical papers by prominent educators in New Mexico, one, "The Automatic and Remote Control Operation of Electrical Machinery," by R. W. Goddard, professor of electrical engineering, New Mexico College of Agricultural and Mechanical Arts, and "Radio Interference from Distribution Circuits," by Philip S. Donnell, professor of electrical engineering, University of New Mexico.

Oil development in the Pecos Valley and electrical development in the cotton belt of New Mexico were the subjects of exposition by representatives from those sections of the state.

A large Colorado delegation was in attendance, including E. F. Stone, president of the Colorado Public Service Association, who made a talk on the activities of that organization, and A. C. Cornell, district manager of the Graybar Electric Company, and chairman of the Electrical League of Colorado, who talked on the relation of the jobber to the utility. A plea was made by John J. Cooper of Denver for the utility men to consider the situation of the so-called "minimum customer" and to develop the interest of the latter, not alone in the service which he is receiving but to encourage an increase in the electric energy which he is using.

The establisment of a plan and the formation of a committee to work out Red Seal wiring operations in the larger cities of the state resulted from the paper presented by Kenneth A. McIntyre of the Society for Electrical Development.

"What is Behind Public Relations," was the subject of a talk given by Walter Heston, of the Electrical World, who also read a paper prepared by George Tenney, managing editor, Journal of Electricity, on "Recent Development of Domestic Load-Building Campaigns."

At the annual business session it was decided to invite other utility companies into membership and to change the name of the association to the New Mexico Utilities Association. Frank Schram, general manager of the Southwestern Public Service Company, Roswell, was elected president; J. B. Ledlie, Mesilla Valley Electric Company, Las Cruces, first vice-president; Donald E. Bent, Tucumcari Light Company, Tucumcari, second vice-president; and B. L. Wiles, of the Albuquerque Gas & Electric Company was re-elected secretary and treasurer. K. W. Kissick of the Deming Ice & Electric Company, retiring president, was placed on the executive committee with E. A. Bradner of Las Vegas and Arthur Prager of Albuquerque. C. C. Ogle, of the Alba Pura Water Company of Las Vegas, also was named a member of this committee.

Although the program was billed for three days, the last portion of it was strictly of an entertainment nature and featured an overnight automobile trip to Jemez Springs, 65 miles northwest of Albuquerque to the La Esperanza ranch. Nearly one hundred made the trip. Although the barbecue was held indoors on account of the weather, the program of dances by Indians from the Jemez pueblo was staged in front of the hotel. The trip and the program which it included are said to be among the most novel convention features ever attempted in the electrical industry.

Hetch Hetchy Standby Service Asked for by Modesto

A request has been made by the Modesto Irrigation District upon the City of San Francisco for standby service of part of the power generated by the city's municipal Hetch Hetchy project, in accordance with the terms of the Raker Act .

The irrigation district has offered to install a step-down station of 9,000-kva. capacity, if the standby service can be obtained from Hetch Hetchy, and has offered to pay for the service at the rate of four mills a kw-hr. for 3,000 kw.

The request was referred to the public utilities committee of the Board of Supervisors, and that committee has invited representatives of the irrigation district to appear before it on March 3 with their engineers for the purpose of discussing the matter.

Delegates to the convention of the New Mexico Electrical Association, taken in front of the La Esperanza Hotel, at Jemez Hot Springs.

Northwest Electric Light & Power Association

Refrigeration, Ranges, Rates Discussed at Commercial Section Meeting

Characterized as a "high-powered" meeting, crammed full of facts ready to be carried home for future use, the first general meeting of the Commercial Section of the Northwest Electric Light & Power Association was held at the Davenport Hotel, Spokane, Feb. 18-19, 1926. More than sixty attended the meetings. No one subject dominated the attention of the meeting. Interest centered nearly equally around the discussions of the range, domestic refrigerator, commercial lighting, rural electrification and residential rates.

The meeting was called to order by the section chairman, P. M. Parry, commercial manager, Utah Power & Light Company, Salt Lake, who introduced V. G. Shinkle, secretary and treasurer, The Washington Water Power Company, Spokane, for the address of welcome. A. C. McMicken, sales manager, Portland Electric Power Company, Portland, responded, sounding the keynote of the meeting. Lewis A. Lewis, sales manager, The Washington Water Power Company, and president of the association next spoke by invitation from the chair, stating that in the past commercial departments of the power companies had not been on a par with such departments in other industries but that executive sentiment was changing in this respect, with the realization that some communities were not growing rapidly industrially and in population, and that an intensive cultivation of business possibilities among existing customers was necessary to produce revenue and to build up load factor.

The balance of the morning session was consumed in a discussion of domestic electric refrigeration, introduced by a member of the committee on that subject, George C. Sawyer, sales manager, Pacific Power & Light Company, Portland, in the absence of its chairman, J. F. Orr, sales manager, Idaho Power Company, Boise. Two definite proposals bearing on advertising policy and promotion methods came out of the deliberation following the report. These were passed, without dissent, the next day in the form of resolutions embodying the opinion of the meeting. The first, addressed to the refrigerator manufacturers, proposed that they co-operate with the central stations in eliminating the manufacturer's profit on such machines as could be placed in the homes of power-company employees. It was thought that a large hindrance to the promotion of this comparatively new device could be removed if a considerable number of officials and employees of the selling company would use the device and that the manufacturers should assist in making this possible. The second resolution was addressed to the executive committee of the Northwest association and was inspired in part by the fact that the Northwest Geographic Division of the Association of Commercial Ice Manufacturers had passed at a recent gathering in Seattle a resolution to be forwarded to the Northwest Electric Light & Power Association requesting a broad-gaged policy in advertising and selling the domestic machines which would not jeopardize the ice business. The Commercial Section's resolution recommended that the executive committee of the association urge its member companies so to conduct their advertising and selling activities as not to antagonize the commercial ice manufacturers, and that they not try to build domestic refrigeration load at the expense of the commercial ice industry.

Sales and Installation Points

Discussion on sales and installation methods and policies brought out the following points: that it is a specialist's job to sell and install; that the long-time trial system without obligation is satisfactory practice; that direct-by-mail advertising to selected prospects is effective; that the machine should be sold at list to produce a merchandising profit which will be needed to spend for promotion; that plants should not be installed in old, inadequately insulated ice boxes; that the sale is simplified if the box and machine are sold complete; that the plant should be installed in the basement with the box in the kitchen, or on the back porch in climates not cold in winter, it being pointed out that in extremely cold weather with the box outside, the machine does not operate enough to freeze ice; that some effort should be directed toward educating contractors and builders to build a refrigerator nook into the kitchen (the tendency in modern houses is toward small kitchens), and that this nook should be of sufficient size to hold a large refrigerator of accepted excellence rather than a locally built box, which in most cases is insufficiently insulated; that if the rate for energy is too low, it might not produce enough gross revenue to cover promotion; and that at some of the lower steps in rates in the Northwest the service will be rendered at a price far below its value.

The refrigeration committee plans to produce as part of its year's report a sample sales manual, as well as a suggested outline of the kind of advertising that should be carried on by selling agencies and manufacturers.

Opening the afternoon session, R. B. McElroy, assistant sales manager, The Washington Water Power Company, chairman of the electric cooking and heating committee, reported that his committee was gathering data from the member companies as to saturation of ranges and water heaters, kilowatt-hour, and revenue statistics, and on selling and advertising policies. These data are to be compiled and presented in the committee's final report for the year.

Discussion went deeply into many phases of securing and handling range business, all of the member companies reporting on their practices. Some of the companies recently have raised their prices to list to allow the furniture stores, department stores and other dealers to sell ranges, believing that this will produce greater volume than the practice in the past of confining the selling agency only to power companies, which generally have offered them at prices close to cost. Disagreement with this new policy arose in some quarters, mainly on the ground that it introduced difficulties in servicing.

Policies on Old Ranges

Another interesting subject discussed concerned the policies toward taking in coal and wood ranges, in which Mr. McElroy explained the successful system used by his company in disposing of such ranges. This involved cleaning up the old ranges and setting up a man in the second-hand range business in a location separate from the company store. The success in this activity is predicated on taking the old range in at a fair value, and under the Spokane company's system this department has made expenses and turned over some profit. The matter of the advisability of conducting intensive campaigns of short duration or extending equal effort over the entire year was discussed without unanimous agreement.

Much interest was displayed in the water-heater discussion, all companies agreeing that they were not getting sufficient revenue from this business, which in the Northwest is carried on mostly by low-wattage flat-rate heaters. Insufficient data on the operation of high-wattage heaters on meter rates, under manual or thermostatic control, led to the hope that means would be effected by the N. E. L. A. to institute a series of tests on such heating business in California by the P. C. E. A. similar to the tests made by the range survey committee in the Northwest. Such tests should produce the necessary data to direct commercial managers toward a decision as to the best policy for developing the water-heating business.

Merchandising Committee Reports

In reporting for the merchandising committee, its chairman, V. H. Moon, appliance sales superintendent, Pacific Power & Light Company, stated that the committee was going to study the merchandising of light. He reported on two recent campaigns on commercial lighting, the first intensive effort in this activity in the Northwest, one conducted by his company, and one by The Washington Water Power Company, in which some startling results in the way of increased revenue were obtained at a remarkably small cost. W. R. Mathews, illumination engineer, The Washington Water Power Company, amplified Mr. Moon's remarks by calling attention to the accumulative effect of such effort, showing how the competitive spirit among merchants in a city led to the desire to

outdo one's neighbor in the matter of lighting up so that the intangible results of such a campaign were manifold. E. L. Crockatt, new business and public relations, Eastern Oregon Light & Power Company, Baker, Ore., told of a campaign put on in Baker which added considerable revenue at small expense, bearing out some of the figures presented by Mr. Moon in his report. P. M. Parry admitted to gaining excellent results from his lighting service bureau, which conducts this activity in Salt Lake the year round. He told of a stand-lamp campaign recently conducted, in which a two-way convenience outlet was offered with each lamp.

J. P. Scott, power sales engineer, Portland Electric Power Company, next reported for the power sales committee, defining the scope of his committee's activities to a study of possibilities in the industrial heating field. This business depends on population and industry and offers a fairly large opportunity in some centers in the territory. Enameling plants and glass annealing plants are two of the principal classes of prospects, and both involve highly technical processes. Especially trained heating engineers are required by the power companies contemplating entry into this field. In districts where these businesses have been developed, notably the bay district in California, a great deal of experimentation with equipment has been necessary before satisfaction with electricity for fuel has been manifested. Among the possible new uses in the field are stereotype pots in newspaper plants and air refrigeration in theaters. One of the principal obstacles encountered in getting manufacturers to change from other types of fuel to electricity is the large expense in equipment involved, making it necessary for the power company to help finance the customer often in large amounts.

R. W. Fayville, sales engineer, Northwestern Electric Company, Portland, told of the possibilities in the bakery field, citing instances in which the installation of an electric oven has saved enough labor to pay for the energy consumption. He stated that it was necessary to work in close co-operation with the oven manufacturers.

Rural Electrification

The Friday morning session was opened by a report on rural electrification by L. A. McArthur, vice-president and general manager, Pacific Power & Light Company, Portland, who heads the association committee and is a member of the national committee on this subject. He told of the origin of the need for investigation and something of the work of the National Committee on Relation of Electricity to Agriculture, stating that some difference of opinion existed as to the theory of the rate to charge for rural service. In some sections of the country the policy is to make the rate carry the extra investment charges, while in the Northwest both central-station companies and regulatory bodies favor a rate but little higher than urban rates, with an advance payment of revenue to absorb the carrying charges on the unproductive portion of the investment. One of the rate theories advanced is that the concentrated urban business should be made to help support the thinner rural business as far as power-company revenues are concerned. He told of a new rural electric service instituted by his company, a description of which will appear in an early issue of the Journal of Electricity.

In introducing the next speaker, E. C. Johnson, dean of the College of Agriculture, Washington State College, Pullman, Mr. McArthur paid a tribute to the quality of co-operation being received from state colleges and experiment stations, which logically have furnished the neutral ground on which to bring together the various interests in investigating the possibilities. Both Oregon and Washington have active committees that have made surveys of the situation in their respective states and are continuing studies of specific subjects suggested by these surveys. He called attention to the finding of the Oregon committee that 15 per cent of Oregon farms were electrified and that it would cost $20,000,000 to build distribution lines alone to reach all of the farms of the state.

Washington Agricultural Survey

Dean Johnson described the organization of the Washington Committee on Relation of Electricity to Agriculture, of which he is the head, and told some of the findings of that committee in its survey conducted last year. The state was divided into districts according to different agricultural conditions, and the saturation of electrified farms, which was over 20 per cent, and the extent to which electricity was used on them, were discovered by this survey. Subjects for investigation during 1926 and subsequently embrace in part the following: the possible uses of electricity in poultry-raising, the community motor, stationary spray pumping, cost of operating wood and coal ranges in comparison to electric ranges, and possibilities in household appliances. The last two were chosen in an attempt to promote the general well-being of the farmer by making his living conditions more attractive, thus tending to keep him and his children on the farm.

W. R. Putnam, vice-president and general manager, Idaho Power Company, Boise, in discussing the subject, stated that in certain localities economic influences prevented the transfer to city customers of any considerable portion of the cost of furnishing rural service, as has been suggested. Some companies have no large concentrations of urban business on which to saddle such burden without hurting the city business. A. C. McMicken called attention to an obstacle in the way of complete rural electrification, in that many farmers could not afford to buy the expensive equipment required to make extensive use of electric service. He urged that the companies not be impatient in expecting immediate results from the work of the state committees, saying that some years would be required before any great good could come of this work.

Range Survey Report

The next subject on the program was the report of the range survey subcommittee, N. E. L. A., by Lewis A. Lewis, chairman. With the aid of stereopticon slides he produced curves and charts resulting from the spring tests in Spokane and Boise last year, as published in N. E. L. A. report 25-91, September, 1925, and abstracted in the Journal of Electricity, Oct. 15, 1925, p. 284. In addition he showed new curves produced in the subsequent winter tests and explained the significance of these data, stating that all the material will be compiled in the final report of the committee at this year's N.E.L.A. convention and cannot be released for publication prior to that time. The intent of the report will be to place in the hands of commercial executives data that can be applied to the system of any particular company, enabling that company to determine whether or not the range business can be made profitable to it.

Residential Lighting Rates

At this point in the meeting an informal discussion of residential lighting rates was introduced, bringing out a variety of opinions as to the merits and demerits of different types of rates. Block rates, room rates, demand rates, load factor rates, and rates based on cost of service, value of service and on what the traffic will bear, were discussed primarily from the standpoint of what constituted an inducement for customers to use more service and create a better load factor. L. R. Lefferson, Electric Bond & Share Company, New York, took part in the discussion, at the suggestion of the chair, telling the results of different types of rates in Eastern cities.

The meeting closed after James S. Carson, American & Foreign Power Company, New York, visiting the meeting, and likewise invited by the chair to speak, told of interesting experiences in conducting a central-station business in Latin America.

Interesting Program Planned for Technical Section Meeting

The program of the third annual general meeting of the Technical Section, to be held at the Olympic Hotel, Seattle, March 11-12, 1926, though incomplete at the time this is printed, indicates that the meeting will be the most interesting yet held by that section. The scheduling of prominent speakers outside the section membership on subjects closely related to the work of the engineers promises to give the meeting a general interest even greater than that of last year.

Among the outside speakers secured for the occasion are Col. William Kelly, director of engineering, N. E. L. A., who is scheduled for Thursday morning on a subject not yet announced; Franklin T. Griffith, president, Portland Electric Power Company, Portland, who will address the meeting Friday, March 12, on the "Relations of the Employees to the Public," with particular reference to construction and engineering employees; and C. W. Fick, General Electric Company, Portland, to speak Thursday afternoon on "New Electrical Applications to the Paper Industry." A. W. Leonard, president, Puget Sound Power & Light Company, Seattle, will welcome the visitors, and Lewis A. Lewis, sales manager, The Washington Water Power Company,

Spokane, and president of the association, will respond.

Other speakers outside the Technical Section scheduled for talks as part of the programs of the different committees are: a member of the Department of Public Works, State of Washington, and a man from the Department of Labor and Industry of that state, both of Olympia, but neither named as yet, as part of the program on the committee on co-operation with regulatory bodies, Thursday morning; M. E. Arkills, safety engineer, Water Front Employers, Seattle, on "Economic Value of Accident Prevention," for the accident prevention committee, Thursday morning; and Lyman Griswold, consulting engineer, Portland, on "Rock and Earth Fill Dams," for the hydraulic power committee, Thursday afternoon.

While all committees are allotted a portion of the time during the two-day session for a presentation of certain phases of their work, all the specific subjects have not been outlined definitely at this time. Those that have been scheduled, besides the above mentioned, are as follows: Accident prevention committee, Thursday morning, "Selling Safety" and "History of Accident Prevention in the Northwest," by G. I. Drennan, field superintendent, Pacific Power & Light Company, Walla Walla, Wash.; hydraulic power committee, Thursday afternoon, "General Survey of Committee Studies," by O. L. LeFever, superintendent, Northwestern Electric Company, Portland; "Paints Adaptable for Hydraulic Use," by E. H. Collins, assistant engineer, The Washington Water Power Company, Spokane; and "Economics of Hydroelectric Design," by C. P. Dunn, designing engineer, Portland Electric Power Company, Portland; apparatus committee, Thursday afternoon, "Mechanical Troubles with Late Types of Oil Circuit Breakers," by Walter Hendron, engineering department, Utah Power & Light Company, Salt Lake City; and "Differential Protection of Neutral Grounding of Generators and Transformers," by R. Rader, engineering department, central district, Puget Sound Power & Light Company, Seattle; underground systems committee, Friday afternoon, "Constructive Criticism and Suggestions for Future Development of Underground Distribution System Apparatus," by J. M. Gilham, underground superintendent, Portland Electric Power Company, Portland, with discussion led by C. H. Hoge, construction superintendent, central district, Puget Sound Power & Light Company, Seattle; and "Manhole Ventilation," by S. B. Clarke, superintendent of underground department, Northwestern Electric Company, Portland, with discussion led by F. L. Rohrbach, underground engineer, The Washington Water Power Company, Spokane.

Committees not yet announcing their definite programs are: Inductive coordination committee, Thursday morning; overhead systems committee, Friday morning; meter committee, Friday afternoon; and prime movers committee, Friday afternoon.

Mike: "Don't you think that the violinist's obligato is beautiful?"

Ike: "I can't say just yet; wait until she turns around."—Two Bells.

Pacific Coast Electrical Association

Final Report of S. F. Conclave of Technical Section

Underground Committee Studies Current Problems

By N. B. Hinson, Vice-chairman

The Jan. 15 meeting of the underground systems committee at the San Francisco conclave was handicapped somewhat by the absence of the chairman, P. E. Chapman, who was ill. However, Mr. Chapman's written report of his trip East to the October national group meetings in Detroit was presented to the committee and aroused a great deal of interest.

According to the report, Mr. Shaw, chairman of the national underground systems committee, N. E. L. A., in outlining the work of that committee stated: "The underground pioneer work is mostly done by a few of the larger companies and if the industry is to progress the underground systems committee must always be somewhat in the lead as regards underground installations. This calls for special work on the committee's part and work which the smaller companies cannot undertake."

In line with this a report of the 75-kv. cable installation being made at Philadelphia and also a report of the 132-kv. cable installations under way in New York and Chicago were read. Interesting discussion followed the presentation of these reports although no Pacific Coast company operates cables at voltages higher than 44 kv. All agreed, however, that some of the Pacific Coast companies may be ready to install cables for higher voltages in the near future. In this event the experience gained by the Eastern companies will be of vital importance.

Increasing use of cement duct has caused considerable interest and discussion pertaining to this type of construction. Several reports were given covering the use of this type of duct. H. H. Buell, of the Pacific Gas and Electric Company, gave a very interesting report on the chemical action of the free lime in the cement on the lead sheath. All companies using cement duct will be glad to learn that these tests have shown that there is no action which will damage the lead sheath. A serial report has been published by the committee (page 52, Jan. 15 issue, Journal of Electricity) giving some data on this subject.

Various new types of motor-driven pumps for underground work were discussed at the meeting. The fact was brought out that there are several new types on the market that are capable of emptying a manhole in less time than the older methods.

The various methods of keeping underground cable, duct and manhole data were discussed. Copies of the different systems used on the Pacific Coast were sent to the chairman of the national subcommittee some time ago. The determination of the temperatures of underground cables and ducts is receiving much attention, and some definite data on experimental installations will be ready in the near future.

Executive Committee to Meet in Los Angeles March 11

A meeting of the executive committee of the Pacific Coast Electrical Association has been announced by Samuel H. Taylor, secretary, to be held at the offices of William Baurhyte, president of the association in Los Angeles March 11. The meeting is to take place in the Los Angeles Gas and Electric Corporation's building at 810 South Flower Street, and is to begin at 2 p. m.

Commercial Section to Hold General Meeting.—March 5 and 6 have been set as the dates for a general meeting of the Commercial Section P. C. E. A. This meeting, which will be held in the auditorium of the Los Angeles Gas and Electric Corporation Building in Los Angeles, will be devoted to putting the Section's papers into proper form for the papers committee, the papers to be presented to the Section chairman for approval at this conference. The work the Commercial Section expects to do at the annual convention also will be discussed.

Plans Under Way for Technical Conclave in Fresno

April 7, 8 and 9 will be busy days for the Technical Section. The Fresno conclave will hold forth on those dates.

While it is not possible to give a detailed program at this time it is known that many matters of importance will come up. The year's work will be rounded out and preliminary plans laid for next year's activities. Although all completed reports to be published prior to the June convention must be submitted to the editing committee in March, much remains that is not complete; thus there is plenty of work in view for the Fresno meetings. In addition to this more or less routine work, the delegates who attended the national group meetings at Kansas City in February will give reports covering the more important features discussed at those meetings.

Entertainment and general arrangements are in the hands of L. J. Moore of the San Joaquin Light & Power Corporation. Many attractive features are promised, including trips to the Balch project and other interesting places.

Permit Granted for Power Project on Deer Creek, California.—P. B. Cross of San Francisco has been granted a permit by the California Division of Water Rights for the development of a power project on Deer Creek, Tehama County, Calif. It is estimated the cost of development will amount to $1,669,648.

News of the Electragists

Electragists of Oakland Begin Work on Red Seal Plan

Definite plans for the operation of the Red Seal Plan in Alameda and Contra Costa Counties were outlined at a meeting held at the Newport Restaurant in Oakland, Calif., Feb. 10. The meeting was attended by seventy-five electragists and other members of the electrical industry.

Laurence R. Chilcote, secretary-manager of the Electrical Contractors and Dealers' Association of Alameda County, presided over the meeting and acted as toastmaster. Clyde Chamblin, president of the California Electrical Construction Company, San Francisco, told the history and development of the Red Seal Plan. He stated the California Electrical Bureau had been granted the sixteenth license from the Society for Electrical Development for the use of the Red Seal Plan. Mr. Chamblin urged everyone in the electrical industry to bring his own home up to the standards of the Red Seal Plan, and stated that all should have all-electric homes. Aside from the personal convenience provided in this way, the sales arguments obtained through personal experience are very valuable in selling similar jobs.

The plan of operation in California was outlined by Victor W. Hartley, executive secretary of the California Electrical Bureau. He stated the standards of the Red Seal Plan are those which reasonably could be expected to be put into every home. Copies of the specifications were distributed to those present. An exhibit of the job card, meter seal and other Red Seal material was shown.

C. Felix Butte, Butte Electrical Equipment Company, San Francisco, chairman of the Northern Division of the California Electragists, stated the electragists were charged with the responsibility of carrying out the operation of the plan. He emphasized the value of the plan to the electragists, and forcibly brought this to their attention by reference to the history of the convenience outlet.

George Bernhard, manager of the East Bay division of the Great Western Power Company, and chairman of the Red Seal committee for district nine comprising Alameda and Contra Costa Counties, urged the co-operation of all members of the industry in making the plan successful. Mr. Bernhard stated that material would be available at power-company offices; also, that samples of all material would be displayed prominently and that someone would be in charge to give out complete information relative to the Red Seal Plan.

Lew Galbraith of the Pacific Gas and Electric Company, vice-chairman of district nine, said that the big job before the industry was the creation of a desire for Red Seal homes on the part of the public. A display board was shown on which service, conduit and wire, switches and meter were mounted as a means of showing customers some of the material necessary to make a range installation.

Harry Woodward, general sales manager of the Great Western Power Company of California, spoke of the accomplishments of the California Electrical Bureau and the good that has resulted from the efforts of the men working for it.

Western Electrical Inspectors Join International

The Western Association of Electrical Inspectors became the Western Section of the International Association of Electrical Inspectors at its twenty-first annual meeting held at the Hotel Sherman, Chicago, January 26-28, 1926. It is hoped that this will be a means of stimulating national interest in the Code and pave the way for a larger and more efficient participation in the work of solving those problems of the electrical industry which relate to the wiring of buildings.

The principal subject under consideration at the convention was the solution of the fuse-abuse problem, and many helpful suggestions were made to guide inspectors in handling this important feature of electrical inspection work. Practically all of the speakers agreed that the solution lay in successfully conveying to the public that the fuse is the safety valve of the electrical installation; further, that a special design of branch-circuit fuse in conjunction with the sealing of the service fuses, together with a firm stand on the part of the municipality to discourage fuse tampering, would contribute to the bringing about of safe fuse conditions. One other outstanding note of the meeting was a clearer realization on the part of the inspectors that they must be of greater service to the public.

This may be accomplished by a more intelligent enforcement of the National Electrical Code, a more complete co-operation with fellow inspectors in preserving the Code by refraining from the adoption of special rules, co-operating with other members of the electrical industry in each community, and protecting the public against the sale of illegitimate material and fittings.

Inspectors to Meet in San Diego in March.—Announcement has been made that the California Association of Electrical Inspectors will hold its next semi-annual meeting in San Diego March 22-24. It is expected that a uniform electrical code for California cities will be one of the important subjects discussed. Complete details of the meeting will be announced in the March 15 issue of the Journal of Electricity.

H. H. Walker, president of the California Electragists, has been elected a vice-president of the Los Angeles Electric Club.

Kaelin & Beer Electric Works, specialists in the repair and maintenance of electric tools and motors, is a newly opened firm at 211 Venice Boulevard, Los Angeles. **H. F. Kaelin** was formerly shop superintendent for the Electric Tool & Repair Service Company of that city.

Atlas Electric Company, San Francisco, now is located in its new home at 343 Fourth Street. The company formerly was established at 1318 Polk Street and 185 Stevenson Street.

Officers of the newly formed Northwest Association of Electrical Inspectors, elected at the convention of that association held in Portland, Jan 11-12, 1926:

President—L. W. Going, chief electrical inspector, city of Portland, Ore.

Vice-president—W. P. Weathers, chief electrical inspector, city of Longview, Wash.

Secretary and treasurer—F. D. Weber, engineer Oregon Insurance Rating Bureau, Portland.

Meetings

Los Angeles Electric Club Holds Election of Officers

Combining business with pleasure the Los Angeles Electric Club in the midst of an interesting entertainment arranged by R. H. Ballard, executive vice-president of the Southern California Edison Company, chairman of the day, held its annual election of officers. The following officers were elected: President—S. E. Gates, of the General Electric Company; vice-presidents—C. A. Heinze, Bureau of Power and Light; H. E. Sherman, Jr.,—Illinois Electric Company; H. H. Walker—H. H. Walker Company; secretary-treasurer—L. E. Mozelle, Bureau of Power and Light; and sergeant-at-arms—H. H. Ranlett, Los Angeles Gas and Electric Corporation.

The executive committee consists of F. E. Geibel, Pacific Electric Railway Company; H. C. Lauderback, Southern California Telephone Company; D. L. Scott, Los Angeles Gas and Electric Corporation; Ray Carruthers, Southern California Edison Company; and G. E. Maudslay, National Carbon Company.

This busy day was also ladies' day, and many members of the fairer sex were present to enjoy the singing of the Edison Chorus and soloist, Miss Mildred Ware.

Interesting Annual Report of Employees' Association

The Traction and Power Mutual Aid Association, composed of employees of the Utah Light & Traction Company, the Utah Power & Light Company, Phoenix Utility Company and Western Colorado Power Company, held its annual meeting Dec. 16 at Salt Lake City and elected the following officers for the ensuing year: president—W. M. Scott; vice-president—G. Alma Gardner; secretary—J. R. Mathews; treasurer—A. M. Rust; directors—Lester Seare, Paul Ashworth, Frank Pickering, J. M. Lindsay and R. M. Parr; auditors — George Partridge, W. E. Zwick; physician—C. E. Openshaw.

The secretary's report showed that the association paid during the year 1925 death claims amounting to $6,000, and for sickness, accident and service refunds the sum of $4,656.50. A surplus amounting to $14,303 was divided among the members in the usual form of a Christmas dividend of $15.16 each for twelve months' membership and fractional time at the same ratio. Nine hundred and seventy-nine members participated in this distribution. The total enrollment now is near the 1,000 mark.

San Diego Electric Club Holds Annual Election

At the annual election of the San Diego Electric Club, San Diego, Calif., held Jan. 19, C. C. Clardy, prominent San Diego electragist, was elected president, succeeding Herbert Rose. Other officers elected were: first vice-president—Ray C. Cavell, of the San Diego Consolidated Gas & Electric Company; second vice-president—C. A. Stevens, manager, Pacific Telephone & Telegraph Company; secretary-treasurer—Percy H. Adams, San Diego Consolidated Gas & Electric Company.

The following five were elected on the executive committee of the organization: H. H. Watson, Al May and W. H. Talbott, of the San Diego Consolidated Gas & Electric Company; Ralph Chase, representative of Westinghouse Electric & Manufacturing Company, in San Diego, and Herbert Rose, retiring president.

Members of the San Diego Consolidated Gas & Electric Company presented a one-act skit; and special musical numbers, dances and other entertainment features arranged by W. H. Talbott, completed an enjoyable program.

COMING EVENTS

Commercial Section, P.C.E.A.—
General Meeting—Los Angeles, in auditorium of Los Angeles Gas and Electric Corporation Building, March 5-6, 1926.

Technical Section, Northwest Electric Light and Power Association—
Annual General Meeting—Seattle, Wash. March 11-12, 1926

Executive Committee, Pacific Coast Electrical Association—
Meeting in office of William Baurhyte, President.
Los Angeles Gas & Electric Corporation Building, Los Angeles.
March 11, 1926.

Transportation Section, P.C.E.A.—
Pacific Gas and Electric Building 245 Market Street, San Francisco, March 12-13, 1926.

California Association of Electrical Inspectors —
San Diego, Calif., March 22-24, 1926.

Electrical Men of Colorado—
State-wide meeting under sponsorship of Electrical League of Colorado
Denver, March 26, 1926

Technical Conclave, P.C.E.A.—
San Joaquin Power Building, Fresno, Calif., April 7-9, 1926.

Transportation Section, P.C.E.A.—
San Francisco, April 23-24, 1926.

Advertising Section, P.C.E.A.—
San Francisco, Calif., April 30, 1926.

National Electric Light Association—
Annual Convention—Atlantic City, N. J. May 17-21, 1926.

Electrical Supply Jobbers' Association—
Annual Convention—Hot Springs, Va. May 31-June 4, 1926

Pacific Coast Electrical Association—
Annual Convention—Biltmore Hotel, Los Angeles June 8-11, 1926

Associated Manufacturers of Electrical Supplies—
Annual Convention—Hot Springs, Va. June 7-12, 1926

Northwest Electric Light and Power Association —
Annual convention — Spokane, Wash. June 16-19, 1926.

Uintah Company Elects Officers.—At the annual meeting of the stockholders of the Uintah Power & Light Company held at Roosevelt, Utah, Feb. 8, the following officers and directors were elected for the ensuing year: President and director—Horace Coltharp, of Vernal; vice-president and director—J. R. Reeder, of Vernal; treasurer and director—Augustus C. Emmert, of Roosevelt; secretary and director—George Adams of Vernal. Other members of the board of directors are: Willis Johnson, Walter Mc Coy and Abner Richens, all of Vernal. A. C. Emmert, who has been active manager of the company for the past three years, will continue in that position. The Uintah Power & Light Company is serving the towns of Roosevelt, Myton, Duchesne, Upalco and Neola, Utah.

Book Reviews

SUPERPOWER—ITS GENESIS AND FUTURE

By W. S. Murray, Murray and Flood, Engineers; Engineering Chairman, U. S. Government Superpower Survey, 9 x 16 in. 228 pp. Illustrated. McGraw-Hill Book Company, Inc., New York, N. Y. $3.

It is extremely fitting that W. S. Murray, one of the fathers of the superpower idea, should interpret the economic and social aspects of this subject. Having become a byword with politician, press and public, it is time that a comprehensive discussion of the subject be brought out before the threatened misinterpretations of the question become real.

In clarifying the meaning of the word Mr. Murray begins with the start of power development in this country and traces its influence on the social and economic life of the people. He points out that superpower is merely the name applied to the plan for getting the best and most nearly universal power service for the nation. He deals with ownership and makes an excellent case for the private utilities.

Briefly reviewing the superpower report of 1918, he shows what has been done to carry out the recommendations made in that early survey. One of the interesting chapters of his book deals with railroad electrification. Mr. Murray argues for a standard electrical system for the contact point and states that every system of electrification tried has been found successful. He shows that utilities should furnish power to railroads and that this would fit in admirably with the economic and social aspects of superpower.

The political aspects of the superpower situation are dealt with, including the place of the Interstate Commerce Commission, the state utilities and the national government. In the opinion of Mr. Murray, the state regulation of utilities is advisable and machinery exists for taking care of any superpower development that involves interstate questions. Superpower, Mr. Murray maintains, is a method of procedure and not a corporation, and its financing problems should be dealt with as are those of utility companies. Charts, statistical data and tabulations are included in the book.

Personals

E. D. Kilburn, recently elected vice-president and general sales manager of the Westinghouse Electric & Manufacturing Company, is making a two-months business trip, during which he will visit the several Pacific Coast offices of his company. He arrived in San Francisco Feb. 19. His present trip is partly one of inspection, but

E. D. KILBURN

while on the Coast he will spend much of his time studying the needs of the great hydroelectric power developments of northern California in the way of new devices, improvements in apparatus and further manufacturing research. Mr. Kilburn received his appointment by the board of directors as vice-president and general sales manager of the Westinghouse company in 1925. In his present position he has direct charge over the sales activities of the company. Mr. Kilburn entered the Westinghouse organization as a graduate student in 1906. Six years later he joined the Westinghouse Machine Company, remaining there in a sales position until 1916 when he was appointed manager of the power and railway departments of the New York office of the Westinghouse Electric & Manufacturing Company. After a year's time he was made manager of the New York district, retaining that position until 1920 when he was made vice-president and general manager of the Westinghouse Electric International Company, the post he held prior to his present capacity. Mr. Kilburn was born in Malone, N. Y., in 1882 and holds degrees from Cornell University in both mechanical and electrical engineering.

E. A. Prokop, engineer in charge of the tunnel work at the Cushman power development project, Tacoma, Wash., has been appointed to take charge of construction of twelve miles of tunnels and appurtenant hydraulic structures for the new water-supply system for the city of Detroit.

B. C. Watts, Denver jobber, has been named head of a committee to investigate and report to the Electrical League of Colorado on the price maintenance bill recently introduced in Congress.

Ed F. Sixtus has been made sales and service engineer for the central California district of the Pacific Electric Manufacturing Company, with headquarters in San Francisco. Mr. Sixtus is very well known throughout the territory, having established many contacts and personal friendships in the industry during the past fifteen years.

F. W. Doolittle, vice-president, North American Company, New York City, has been making an extensive inspection trip over the properties of the Great Western Power Company of California and the San Joaquin Light & Power Corporation, accompanied by J. B. Black and A. Emory Wishon, vice-presidents and general managers, respectively, of those two subsidiary corporations.

O. R. Doerr, formerly manager of the home department of the Oakland division of the Great Western Power Company of California, has become manager of the heater division of the Magnavox Company, Oakland. He is at present making an extensive Eastern trip.

H. W. Dennis, construction engineer, Southern California Edison Company, Los Angeles, attended a meeting of Engineering Foundation's arch-dam investigation committee in San Francisco on Feb. 11 at which plans for advancing the work described elsewhere in this issue were discussed. This was the first meeting to be presided over by Prof. C. D. Marx, the newly elected chairman.

Lafayette Hanchett, president of the Utah Power & Light Company, has been elected chairman of the board of directors of the Salt Lake City branch of the Federal Reserve Bank of San Francisco. Mr. Hanchett succeeds **G. G. Wright,** who served as chairman during the past year.

Ray W. Turnbull, San Francisco, Pacific Coast district manager of the Edison Electric Appliance Company, was in Los Angeles on business not long ago.

F. J. McEniry, head of the publicity department of KOA broadcasting station of the General Electric Company in Denver and formerly a staff member of the electrical league in that city, was a Pacific Coast visitor recently.

A. E. Holloway, superintendent commercial department, represented the San Diego Consolidated Gas & Electric Company at the recent convention of California Electragists at Catalina. Mr. Holloway was appointed chairman of District No. 23, San Diego County.

George B. Muldaur, general agent of the Underwriters' Laboratories, Inc., New York City, visited Portland on Jan. 25 and 26, on a tour of the Pacific Coast for the purpose of addressing chambers of commerce, Rotary clubs and other civic bodies, on the subject of "Underwriters' Laboratories Service in Fire Prevention." He spoke before the Portland Chamber of Commerce and the Portland Rotary Club.

R. L. Watts, of the firm of Lewis & Watts, engineers, specializing in power plant design and construction, wiith offices in Seattle and Portland, has sold his interest to **H. H. Lewis,** who will conduct the business under its present name. Mr. Watts is joining the Compressed Spruce Products Company, Inc., in which he is interested.

J. A. Harlan, executive of the Delco Light Company, Dayton, Ohio, recently spent a week in Los Angeles. He was making a survey of economic conditions throughout the country, Los Angeles being the last stop on his itinerary prior to his return home.

W. H. Davie, district manager of the Los Angeles office of Allied Industries, Inc., **W. H. Klinger,** vice-president of the company with headquarters in Los Angeles, **R. C. Shipman,** district manager at Seattle, **W. J. Cottrell,** district manager at Portland, and **S. P. Vonah,** district manager of the Oakland office, attended the recent district managers' meeting of the Allied Industries, Inc., held in San Francisco.

A. M. Chitty has been named manager of the southern district of the Puget Sound Power & Light Company, which embraces territory from Olympia, Wash., south to the Columbia River. Mr. Chitty's headquarters will be in Chehalis, Wash., where the company has taken offices in the Elks Building. He succeeds **E. T. Steel,** who becomes manager for the company's western district, with headquarters in Bremerton, Wash.

E. T. Steel, newly appointed manager of the western district of the Puget Sound Power & Light Company, was a recent speaker before the Rotary Club, at Port Angeles, Wash. In his address Mr. Steel explained the service and rates that the company offers its customers. **J. L. Keeler,** resident manager of the Puget Sound Power & Light Company at Sequim, Wash., also addressed the club, explaining the company's activities in Clallam County. He also gave an explanation of how public service utilities are regulated by the state.

William H. Hawkes, formerly treasurer of the Puget Sound Power & Light Company, at Olympia, Wash., has been appointed assistant treasurer of the company for the entire eastern district. He will remove to Wenatchee.

L. W. Failor, manager of the offices of the Puget Sound Power & Light Company at Auburn and Sumner, Wash., has been transferred to Olympia where he will have charge of the sales department. He is succeeded by **Roy McGandy,** who has been assistant manager for several years.

Max K. Stewart, formerly division sales manager, Pacific Gas and Electric Company, Redding, Calif., has become a representative of the Walker-Pratt Manufacturing Company, with headquarters in San Francisco.

E. C. Van Diest, organizer and president of the Western Public Service Company which sold its holdings in Wyoming, Nebraska, Colorado, Missouri and Texas to Stone & Webster several months ago, has retired definitely from the utility business. Mr. Van Diest is devoting his time to the interests of the Kiwanis Club in the Rocky Mountain region as immediate past governor in connection with child welfare work. He also heads the committee in Colorado Springs, Colo., which will build a new stadium at Colorado College.

Ralph Pool, vice-president in charge of operations of the Western Public Service Company with headquarters at Colorado Springs until purchase of that company by the Stone & Webster interests several months ago, has joined the ranks of the Electric Bond & Share Company.

D. C. McClure, general superintendent of the St. Joseph Light, Power & Railway Company, St. Joseph, Mo., and formerly superintendent of the electric department of the Public Service Company of Colorado, Denver, has resigned his position to become vice-president of a Midwestern utilities holding company with headquarters in Chicago. Mr. McClure at the time of his transfer to the Missouri property was president of the Rocky Mountain Division, N.E.L.A.

H. E. Mahan, illuminating engineer for the General Electric Company at Schenectady, spent several days not long ago in San Diego in connection with navy research work.

E. O. Shreve, manager of the San Francisco district, General Electric Company, and **J. V. Anthony,** Pacific Coast auditor for the same company, were recent business visitors in Los Angeles.

C. E. Heise, district manager, Westinghouse Electric & Manufacturing Company; **H. E. Sandoval,** general manager, Sandoval Sales Company; **F. H. Woodward,** general sales manager, Great Western Power Company, and **Victor W. Hartley,** executive secretary, California Electrical Bureau, all of San Francisco, attended a meeting of the advisory committee of the California Electrical Bureau in Los Angeles a short time ago.

F. F. McCammon, of the Public Service Company of Colorado, and **Charles Sterne,** of the Arapahoe Power & Light Company, were the official Denver representatives at the recent N.E.L.A. range committee meeting in Salt Lake City.

E. K. Higginbottom, representative of the Kuhlman Transformer Company has been working in the Mountain region for a number of weeks with the district representatives of the company, the Globe Electric Supply Company of Denver.

B. E. Rowley, district manager of the Edison Electric Appliance Company, has been elected vice-chairman of the Rocky Mountain Electrical Cooperative League in Salt Lake City recently.

Lafayette Hanchett, president of the Utah Power & Light Company, addressed the engineering students of the University of Utah in Salt Lake City at a special assembly on Jan. 26.

H. P. Whitten, division manager of the Apex Electrical Distributing Company, Denver, has been transferred to the Northwestern district of the company with headquarters at Seattle.

R. S. Willoughby, R. L. Lindsay and **C. S. Morash** recently have entered into a new electrical enterprise in Denver. They are incorporated under the name of Gainaday Distributing Company and will be established at 232 Fifteenth Street.

Charles Franck, vice-president and general manager of the Holophane Glass Company with headquarters in New York City, is a visitor on the West Coast with his family. En route he stopped at Chicago and Denver in the interest of company representation.

Arthur Prager and **C. L. Pinkerton,** of the Albuquerque Gas & Electric Company, Albuquerque, N. M., visited Denver late in January in the interest of the recent annual convention of the New Mexico Electrical Association in Albuquerque.

L. M. Cargo, district manager of the Westinghouse Electric & Manufacturing Company in Denver and a recent visitor to San Francisco and Los Angeles, is chairman of the special program committee arranging the statewide meeting of electrical men to be held in Denver March 26 under the auspices of the Electrical League of Colorado.

A. W. Berresford, for about twenty years vice-president and general manager of the Cutler-Hammer Manufacturing Company, Milwaukee, recently was appointed executive vice-president of the Nizer Corporation, Detroit, which not long ago was consolidated with the Kelvinator Corporation and the Grand Rapids Cabinet Company, operating as divisions of the Electric Refrigeration Corporation. Mr. Berresford is a past president of both the Electrical Manufacturers Club and the Associated Manufacturers of Electrical Supplies and at present is vice-president of the American Engineering Council.

F. C. Gordon, manager of the insurance department, Byllesby Engineering & Management Corporation, visited the San Diego Consolidated Gas & Electric Company early in February. Mr. Gordon has been touring the Coast, making a close study of the safety practices of various companies.

C. A. Semrad, vice-president and general commercial manager of the Public Service Company of Colorado, visited the New York offices of the Doherty Company early in February.

H. L. Williams, manager of the Evanston (Wyoming) division of the Utah Power & Light Company, has been re-elected as a director of the Rocky Mountain Committee on Public Utility Information.

J. F. Lincoln, executive vice-president of the Lincoln Electric Company, Cleveland, has been making a six-week trip to the important industrial territories in the country. Included in his Western itinerary are Los Angeles, San Francisco, Portland, Seattle, El Paso, and Phoenix.

Edward A. Sipp, formerly project electrical engineer for the Army Air Service Engineering Division at McCook Field, Dayton, Ohio, in charge of development of electrical gun synchronizers, airplane, airdrome and airways illumination, electrical wire and cable, and miscellaneous electrical equipment, has been appointed aviation research engineer in charge of the development of special cables for airplane and similar products manufactured by the Belden Manufacturing Company, Chicago.

Marjorie A. Stolz, formerly supervisor of educational work for the Proctor & Gamble Distributing Company in different localities in California, has joined the force of the Walker & Pratt Manufacturing Company as home economist in charge of educational work throughout the West. **Max K. Stewart,** formerly sales manager for the Shasta division of the Pacific Gas and Electric Company, has become the representative of the Walker & Pratt Company in northern California, and **John W. Carpenter** the company's representative in southern California. These changes recently were announced by **Burton Y. Gibson,** Pacific Coast manager.

G. P. Baldwin, general merchandising manager of the General Electric Company, recently was elected a vice-president of the company at a meeting of the executive committee. In his new position he will have charge of activities connected with the electrification of steam railroads and such other duties as may be assigned by the president. His new headquarters will be in New York City. Mr. Baldwin was born in San Francisco in 1874, and graduated from Leland Stanford University in 1896 with the A. B. degree. In the following year he entered the employ of the Stanley Electric Manufacturing Company. At that time Mr. Baldwin became vice-president of the Blaisdell Company of Los Angeles where he remained until March 16, 1910, when he was made manager of the Pittsburgh office of the General Electric Company. In 1915 he was made manager of the Atlantic district with headquarters in Philadelphia. When the merchandising department was created in 1923 he was made its first manager.

G. P. BALDWIN

Miss Edith Clarke, an engineer of the General Electric Company at Schenectady, N. Y., for the past six years, and one of the five women members of the American Institute of Electrical Engineers, was the first woman ever to address the Institute when at its recent midwinter convention in New York City she delivered a paper on "Calculation of Steady-State Stability in Transmission Lines."

Herbert Cram, formerly with Landers, Frary & Clark, has resigned his position with that company to become factory representative for the Edison Electric Appliance Company covering central and northern California, with headquarters in San Francisco. **J. J. Burns** has been given charge of the territory south of San Francisco.

Obituary

W. J. Santmyer, for the past twenty-seven years connected with the Puget Sound Power & Light Company, Seattle, died in Rochester, Minn., Jan. 24, after a short illness.

TRADE NOTES

The Bluebird Electric Shop, 1105 Broadway, Tacoma, Wash., has been appointed exclusive distributor in that territory for the **Electro-Kold Corporation.**

Rome Wire Company, Rome, N. Y., has issued an illustrated 42-page booklet on bare copper wire. The various types of wire are described fully and extensive tables are given in the booklet.

The Pyle-National Company, Chicago, claims a new type of floodlight projector in its No. 2375. Ventilation has been dispensed with entirely and the cast-aluminum alloy case has an absolutely tight closure, with machined surfaces at the door joints and a soft lead packing ring, a drawn aluminum back and fittings and small parts of aluminum or bronze, according to the manufacturers.

The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has brought out recently a new line of motors called the "Flywheel Type" and is now in a position to furnish this machine as engine type alternator. This type of alternator construction creates a self-contained power unit, being an integral part of the engine and occupying less space than the old design.

Electrical Products Corporation, Los Angeles, recently has issued bulletins Nos. 20 and 21. The former presents the latest designs in stage lighting, footlights, border lights and strips. Illustrations and price lists are given. Bulletin 21 covers interior theater lighting.

Ohio Brass Company, Mansfield, Ohio, has developed a new metal which it has called "Flecto" iron. This is a type of malleable iron which by virtue of a heat-treating process, is freed from all tendency toward embrittlement when hot-dip galvanized. While retaining all of the desirable characteristics of malleable iron, it is claimed the Flecto process so improves the metal with added valuable properties that it is considered to be practically a new metal.

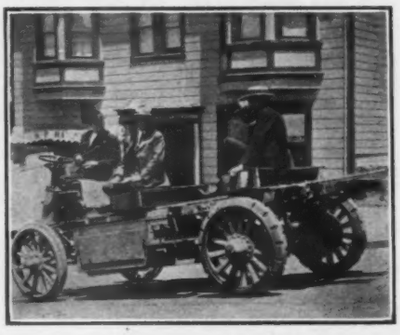
Willamette Iron & Steel Works, Portland, Ore., now are manufacturing and distributing the Jones-Willamette bearing, which possesses the dual features of automatic circulation and filtration of oil. The bearings are manufactured in all styles—flat bottom, internal collar, drop hanger, rigid post, bell and socket, and various other types for special purposes. A descriptive bulletin is available.

Eddings Electric Store of 652 Honolulu Avenue, Montrose, Calif., has found it necessary to move into larger quarters and has taken store space in a new building at 633 Honolulu Avenue, into which he will move his stock of appliances, radio and other goods at once.

The Foxboro Company, Inc., Foxboro, Mass., has moved its Pittsburgh office from the Park Building to the Foxboro Building, Sixth Avenue and Grant Street. **H. S. Gray** will continue to be in charge of the Pittsburgh branch.

Manchester Electric Company recently opened an electric fixture and supply store at 8501 S. San Pedro Street, Los Angeles. The proprietors, V. Dionne and W. G. Potter, have purchased the business formerly owned by Birkel & Merigold of W. 7th Street. They will specialize in fixtures and appliances as well as radio.

The San Pedro Electric Company, 263 W. 6th Street, San Pedro, Calif., has found it necessary to remodel its entire store to accommodate its appliance display. Special wall cabinets and removed partitions allow greater floor space as well as radio demonstrating room.



During the P.C.E.A.'s electric truck school in San Francisco last June the Commercial Truck Company made some demonstrations on some of the city's well-known hills as part of the course of study. The accompanying picture shows John D. Scott, commercial engineer, Portland Electric Power Company, Portland, (behind the driver) enjoying a demonstration on Telegraph Hill. The driver is William Hutton, sales engineer, Commercial Truck Company, San Francisco, while on the rear seat are William Otis, publisher, "Western Truck Owner," San Francisco, and H. E. Cowgill, distributor, Commercial Truck Company, Portland.

Lee B. Mettler Company, Los Angeles, Calif., has issued a condensed catalog in unique form. It is printed on both sides of a single sheet of heavy pressboard, 10 x 11⅝ in. in size to fit the standard letter file, with projecting letter tab. Mr. Mettler calls this simplified method of cataloging, "the Mettler advertising system and file card therefor," and is attempting to get every original manufacturer in the United States to present his product in the same way because of the advantages resulting from the simplification. Patent covering the system has been applied for.

The Wagner Electric Corporation has moved its Omaha office to 2566 Leavenworth Street in that city.

General Electric Company, Schenectady, N. Y., in its 43-page bulletin No. GEA-10, fully describes and illustrates its various types of mechanically operated flow meters for measuring fluids and gases. Diagrams and tables, together with price lists, are included in the booklet.

H. E. Williamson & Company, manufacturers of the "California Maid" electric clothes-washing machine, have moved to 425 Fourth Street, San Francisco.

Savage Arms Corporation, Utica, N. Y., has designed and developed the Savage All-Electric Ironer with the forearm typewriter touch control. All the interesting features are described and illustrated in the folder just issued by the company.

Gainaday Electric Company, Pittsburgh, Pa., has perfected an advertising and publicity plan whereby through an arrangement with the Universal Picture Corporation all Gainaday dealers may tie in their Gainaday publicity with the "Little Giant" motion picture, when shown in their respective cities. The picture is built around an electric washing machine. A folder containing advertising and merchandising suggestions in connection with this plan has been issued by the company.

Condit Electrical Manufacturing Corporation, Boston, has issued a reprint of the paper presented by George A. Burnham at the Philadelphia convention of the Association of Iron and Steel Electrical Engineers. The purpose of the paper, which covers "The Selection and Maintenance of Oil Circuit Breakers," is to bring out for discussion the fundamental factors which should be given careful consideration in the selection of control and protective devices in heavy industrial service. The paper is illustrated with drawings and photographs.

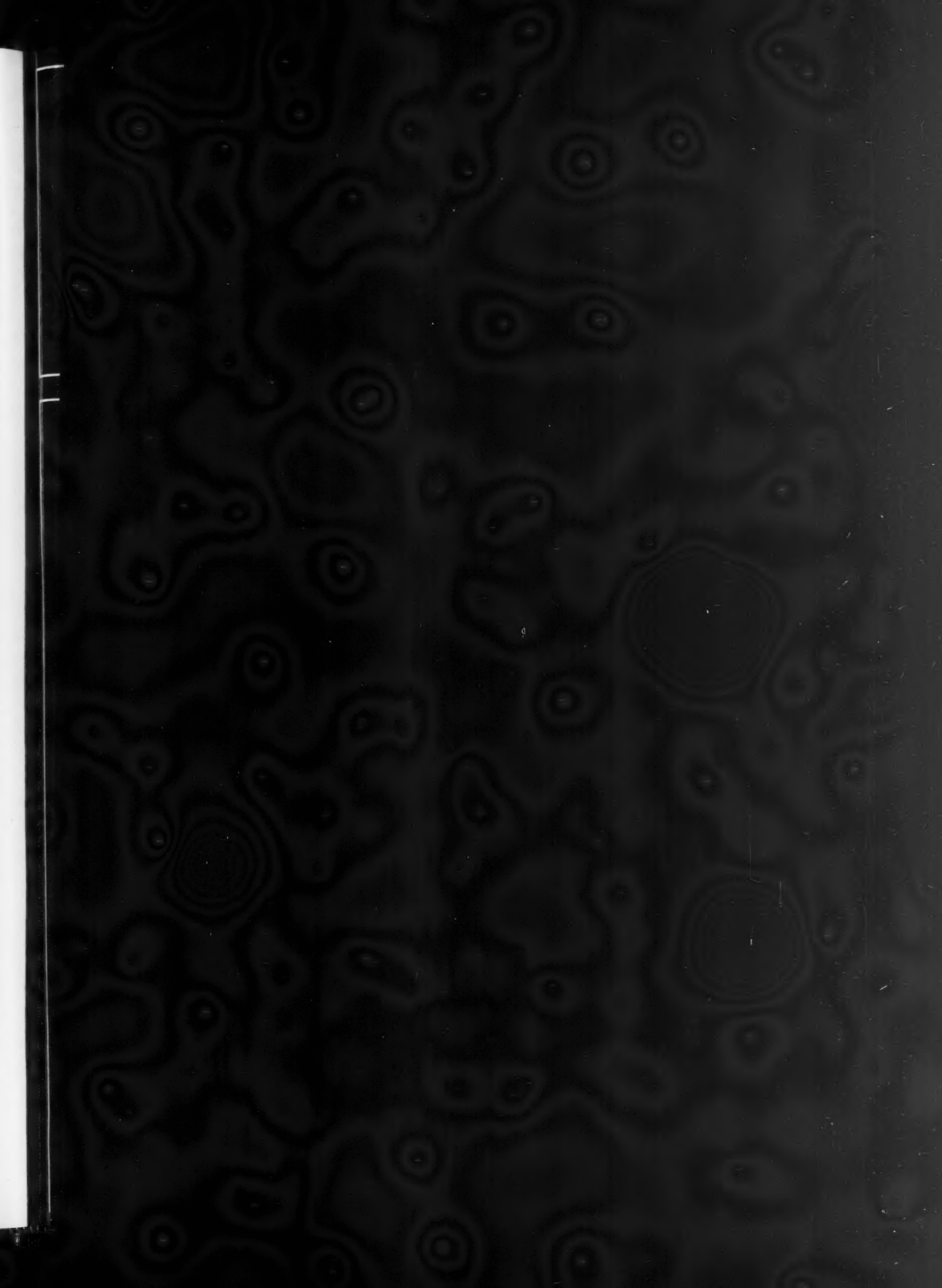
The Griscom-Russell Company, New York City, has removed its general offices from 90 West Street to the new Murray Hill Building, 285 Madison Avenue, that city.

The Mills Electric Company, 326 Pine Avenue, Long Beach, Calif., is preparing to move into a new store at 436 Pine Avenue. H. E. Mills, the proprietor, states that he will add a radio department in the new store, which will be much larger than the present one.

The Allen-Bradley Company, Milwaukee, manufacturers of electric controlling apparatus, has published recently a bulletin on its type F-2250 crane, hoist and mill controller for general crane and mill service.

The Wesco Company, Inc., manufacturers' agent in Denver, has been assigned the accounts of the **National Metal Molding Company** and the **Pittsburgh Reflector Company. O. P. Willoughby,** president of the company, recently returned from an extended Eastern trip, and will shortly announce the procuring of additional representative lines.

The Ward Leonard Electric Company, Mount Vernon, N. Y., now is building its Vitrohm circular-plate generator and motor-field rheostats with pressed-steel instead of cast-iron plates. The new design permits lighter and much stronger plate to be supplied for the same duty.

The Servel Corporation has opened district offices in Denver at 924 Gas & Electric Building under the direction of **Harold Smethills.**

J. G. Pomeroy Company, of Los Angeles and San Francisco, has been appointed Pacific Coast representative for the Erie Malleable Iron Company of Erie, Pa., manufacturers of Kondu fittings.